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A META-ANALYSIS OF THE PRODUCTIVITY MEASUREMENT AND ENHANCEMENT SYSTEM

A Dissertation

by

ANTHONY R. PAQUIN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 1997

Major Subject: Psychology

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Approved as to style and content by:

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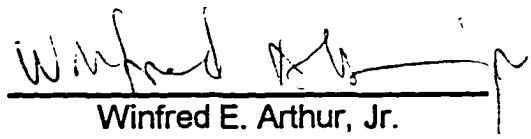
(Chair of Committee)



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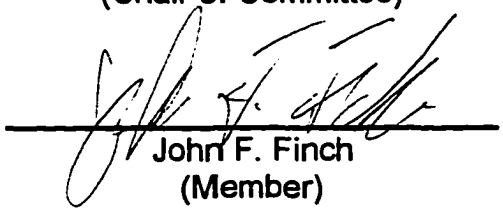

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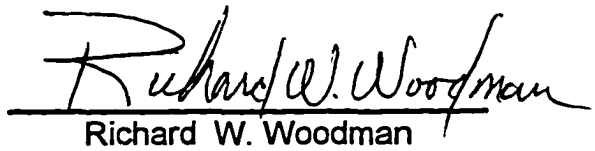

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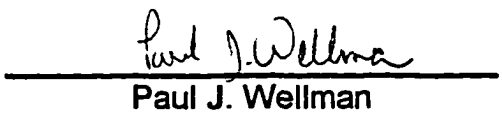

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ABSTRACT

A Meta-Analysis of the Productivity Measurement

and Enhancement System. (August 1997)

Anthony R. Paquin, B.A., Assumption College; M.S., San Diego State University

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Organizations must be concerned with productivity growth to remain competitive in the global marketplace in which they now compete. One productivity improvement intervention available to organizations is the Productivity Measurement and Enhancement System (ProMES). Although it has been successfully applied in a wide variety of organizational settings, the degree of impact of ProMES on productivity has varied considerably. The goals of this study were the following: (a) create a ProMES database with information on variables potentially related to the impact of ProMES on productivity; (b) conduct a meta-analysis of database information to estimate the effect of ProMES, and (c) begin to identify the specific factors that contribute to the success or failure of ProMES projects. Results revealed an average effect size of 1.20 or 1.65 (depending on estimate used). These results suggest that the effect of ProMES on productivity is quite large relative to other interventions. However, before a final conclusion can be drawn about the comparative effectiveness of ProMES, it should be noted, that it is difficult to determine if effect sizes estimated in time series studies are directly

comparable to effect sizes associated with other research designs. As such, care should be taken with regard to interpreting the impact of ProMES relative to other interventions by directly comparing the effect sizes reported here with other reported in the literature. Results also identified that the incremental informational value provided by ProMES feedback was significantly related (r = .60) to the amount of productivity gain associated with ProMES interventions. In addition, the present study revealed that the similarity of the intervention process with the original system development and implementation process described in Pritchard (1990) was a strong moderator of the strength of the effect.

DEDICATION

Once again, to my parents without whose emotional and financial support this would not have been possible. Also, to my Aunt Lorraine Parkhurst, who over the years has been my number one fan and supporter.

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I would like to especially thank Bob Pritchard, my advisor, for all his guidance and patience. I know that I was not always the easiest student to advise, but I hope the experience was not too trying. I would also like to thank the professors on my committee, Winfred Arthur, John Finch, Dick Woodman, and Lee Cartwright for their guidance and cooperation in meeting deadlines on short notice. I wish to express special thanks to Dick Woodman, Paul Wellman and Tony Bourgeois for the confidence they had in me to teach courses in their departments. In addition, I would like to express my gratitude to Mike McCormick, Arlette DeCuir, Mark Stewart, Paul Bly, and Anne-Kathrin Sandow for their editorial comments and all the work they did on the database. Also to Amy, Amie, Tera, Sara, Kelly, Alicia, Kristi, Fred, Kimberly, and especially Amanda, for all the time and effort you put forth to help get the database up and running. I would like to give credit to Maureen Schoonen, Noga Gottesfeld, Yuri Henkin, and the members of the ProMES Mafia for their contributions to the development of the database questionnaire. Finally, I would like thank Kim Cozzi for helping me get my dissertation ready for submission to the thesis clerk and for all the other things you have helped me with over the last couple of years.

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INTRODUCTION

Productivity growth is important because it has consequences at multiple levels. For instance, productivity growth has been associated with national prosperity, the survival of industries, the prudent use of natural and human resources, and improvements in quality of life (Pritchard, 1990). Another important consequence is the inflation-productivity relationship. Many people in this country would like higher wages. However, if wages increase without corresponding increases in productivity, costs would go up, which, in turn, would lead to increased inflation (Kendrick, 1984; Kopelman, 1986; Pritchard, 1990). Thus, improvements in productivity can help moderate inflation, and thereby improve our standard of living.

Evidence for the importance of continued productivity growth was demonstrated in 1985. In that year the Bureau of Labor Statistics reported that the rate of productivity growth in the United States had been declining over the previous 15 years (Ralston, Anthony, & Gustafson, 1985). The significance of this phenomena was such that then President Reagan asked Congress for a joint resolution designating productivity improvement as a national goal (Tuttle & Weaver; in Pritchard, 1990). Fortunately, the decline in productivity growth appears to have leveled off over the last few years. However, productivity

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growth is still significantly less than it was prior to 1970 (Bureau of Labor Statistics, 1995), and, for that reason, remains a national concern.

Organizations must also be concerned with productivity growth. As Tuttle (1983) writes, although modifications need to be made at the national level, "ultimately the productivity battle will be fought and won in the individual organization in the individual workplace" (p. 479). Organizations need to be as productive as possible to remain competitive with rival organizations (Pritchard, 1995). All other things being equal, the organization with the highest productivity growth is the one most likely to survive (Craig & Harris, 1973; Kendrick, 1984, Pritchard, 1990; Tuttle, 1983). Survival is becoming more and more difficult in the global market place in which organizations now compete. Consequently it is crucial that organizations find methods to best utilize their precious resources.

One method that has produced impressive results in a variety of settings is the Productivity Measurement and Enhancement System (ProMES; Pritchard, 1995). To date, ProMES has been implemented in over 90 different groups, in 10 different countries, on 3 continents. It has been used in manufacturing, service, and white collar settings, in different industries, with varying technologies, and with workers whose education level ranges from no high school diploma to college professors (see Appendix A for example settings).

While much has been learned from these projects, there is still a great deal left to learn. For example, although it has been demonstrated that

ProMES can be successfully applied in a wide range of settings (Pritchard, 1995), the magnitude of success has varied considerably across settings. Many ProMES researchers have speculated on the factors which determine the effectiveness of a ProMES intervention. However, it is difficult to identify many of these factors from the results of individual studies because each study reveals only a part of the picture. Information needs to be combined across studies for the big picture to emerge.

The primary goals of this study, therefore, were threefold. The first was to identify all variables that could potentially be related to the success of a ProMES project, develop an instrument to assess these variables, and use it to create a database with information from as many ProMES studies as possible. This database will be updated as new ProMES projects are completed. The information in the database will then be made available to other ProMES researchers to assist them in answering questions concerning ProMES specifically and productivity interventions in general. The second goal was to provide an updated estimate of the average effect of ProMES on productivity. Past research (Pritchard, 1990, 1995) had shown ProMES to be a very powerful intervention. The present study provides an updated estimate of the impact of ProMES on productivity by basing the estimate on a significant number of additional projects and by examining the relative merits of several different effect size estimates. The third goal of this study was to begin identifying the

specific factors which contribute to the relative success or failure of ProMES projects.

The following sections will provide a brief summary of the conceptual background of ProMES, illustrate the steps involved in a ProMES intervention, explain how information will be combined across studies, describe the procedure used to develop the ProMES database, and, finally, elaborate on the specific research questions to be addressed in this study.

Conceptual Background of ProMES

ProMES is based on a theory of behavior in organizations developed by Naylor, Pritchard, and Ilgen (1980). According to this theory (referred to as NPI theory), people are most motivated when they perceive clear connections between the following relationships: (a) their behavior and the results or "products" of their behavior; (b) their products and their evaluations; and (c) their evaluations and the outcomes they receive. When these connections are clear, unit personnel are better able to direct their efforts and, as such, be more productive with the same amount of effort.

Using NPI theory as a conceptual framework, Pritchard and his graduate students (Pritchard, Jones, Roth, Stuebing, & Ekeberg, 1988, 1989; Pritchard, 1990) developed a productivity measurement and feedback system which increases productivity by creating conditions which allow unit personnel to clearly perceive the aforementioned connections thereby increasing motivation. The underlying premise of ProMES is to give people the tools to work smarter,

provide them a sense of ownership in the measurement system, and empower them to determine how they should focus their efforts.

One of the most important elements of ProMES is feedback. With ProMES, workers receive formal feedback reports on a regular basis which enables them to develop strategies to improve effectiveness and to assess the success of these strategies. Another important element is the involvement of unit personnel in developing the system. According to the proponents of ProMES, one of the benefits of this high level of involvement is that the feedback provided by the system is perceived as being more valid (Pritchard, 1990).

Steps in Developing ProMES

The six basic steps in developing ProMES are as follows: (1) Forming the design team; (2) identifying objectives; (3) developing indicators; (4) establishing contingencies; (5) designing the feedback system; and (6) giving and responding to feedback.

Forming the Design Team

The first step in developing ProMES in an organization is to form the design team. The design team is the group of individuals who are primarily responsible for developing the measurement and feedback system. In situations where the target unit is small (e.g., less than eight members), the entire unit usually serves on the design team. If the target unit is large, 5 to 6

employee representatives are selected to serve on the design committee. Some design teams also include the immediate supervisor(s).

There are also usually 1 to 2 facilitators familiar with the ProMES process on the design team. The function of the facilitators is to guide the discussion and to help resolve differences that arise during the development process. In most situations, discussion continues until a consensus is reached on a final list of objectives, indicators, and so on.

Identifying Objectives

The first task of the design team is to identify the set of activities the target unit has to perform to do their job. These activities are referred to as objectives. Typically three to five objectives are identified by the design team.

An abbreviated example of a unit in which ProMES was implemented (Pritchard, 1990) will be used to illustrate the steps involved in developing a ProMES system. The unit was a small production team working in a plant which produced electronic circuit boards for computer-related equipment. The circuit boards were assembled and tested in a serial fashion by a number of units, and, as such, a given team could not complete more boards than the previous group had prepared for them. The target unit in question was responsible for the final steps of production. Once a board was completed by the target unit, it was sent to a second unit for inspection. Boards which were necessary to complete a customer's order on time were designated as high priority since it was necessary to complete these boards on a given time schedule. The unit

was also inspected on a regular basis to insure that they were complying with a series of maintenance and housekeeping/safety procedures. In this unit the following objectives were identified by the design team:

1. Maintain High Production
2. Make Highest Quality Boards Possible
3. Maintain High Attendance
4. Correctly Follow Housekeeping and Maintenance Procedures

Developing Indicators

Once objectives have been identified, the design team must identify or develop quantifiable measures which indicate how well the target group is meeting these objectives. Some indicators may already exist, while others may have to be created. An objective may have one indicator or it may have several. In the example target unit, the final list of objectives and indicators were as follows:

Objective 1. Maintain High Production
- Indicator 1: Output - Percent of boards completed. Number of boards completed, divided by number needed.
- Indicator 2: Meeting Priorities - Number of high priority boards completed, divided by number needed.

Objective 2. Make Highest Quality Boards Possible
- Indicator 3: Inspections Passed - Percentage of boards passing inspection.

Objective 3. Maintain High Attendance
- Indicator 4: Percent Hours Worked - Total hours worked divided by maximum hours possible to work.

Objective 4. Correctly Follow Housekeeping and Maintenance Procedures
- Indicator 5: Audit Violations - Number of violations of a general audit of housekeeping and maintenance procedures.

After a consensus is reached on the list of objectives and indicators, they are presented to upper management for approval. Any disagreements between upper management and the design team are resolved and modifications are made if necessary.

Establishing Contingencies

Once objectives and indicators are formally approved, the design team begins the process of establishing contingencies. Contingencies represent the relationship between the different amounts of the indicator, and how much these amounts contribute to the overall effectiveness of the target group. A formal step-by-step process is used to establish contingencies. The first step is to identify the best and worst possible indicator levels the target group can reasonably expect to occur. Second, the design team determines what level of performance just meets expectations for each indicator, in other words, the level that is neither good nor bad, but is acceptable to management. This level is referred to as the zero point in ProMES terminology. Third, the relative contributions of the minimum and maximum indicator levels towards the overall effectiveness of the unit are determined. Finally, once the effectiveness levels of the minimum, maximum, and zero point have been established, the design team discusses and decides upon the shape and placement of the remaining points in the function.

The contingencies developed for the indicators in our example are shown in Figure 1. The horizontal axis in each of the contingencies represents

the varying amounts of the indicator. The vertical axis represents the effectiveness score, which can be defined as the level of contribution being made to the organization by the target unit. Indicator amounts above the "zero point," are considered above expectations, and those below are considered below expectations. The line (function) in each graph represents the relationship between the varying amounts of the indicator and the effectiveness of the group.

After contingencies have been completed for all indicators, they are presented to upper management for review and approval. Once any disagreements are worked out and formal approval is received, the measurement part of the ProMES system is essentially complete.

Designing the Feedback System

The next step is to collect data for all of the indicators, compile this information into formal written feedback reports, and then distribute them on a regular basis. More specifically, information on each of the indicators is collected for a given work period. In most cases this work period is either a week or a month depending on the type of job. Effectiveness scores are calculated for each of the indicator values according to the functions described in the contingencies. The indicator values and corresponding effectiveness scores for each objective are included in the feedback report. This results in an effectiveness score for each indicator ranging from below expectations (negative value) through meeting expectations (zero) to above expectations

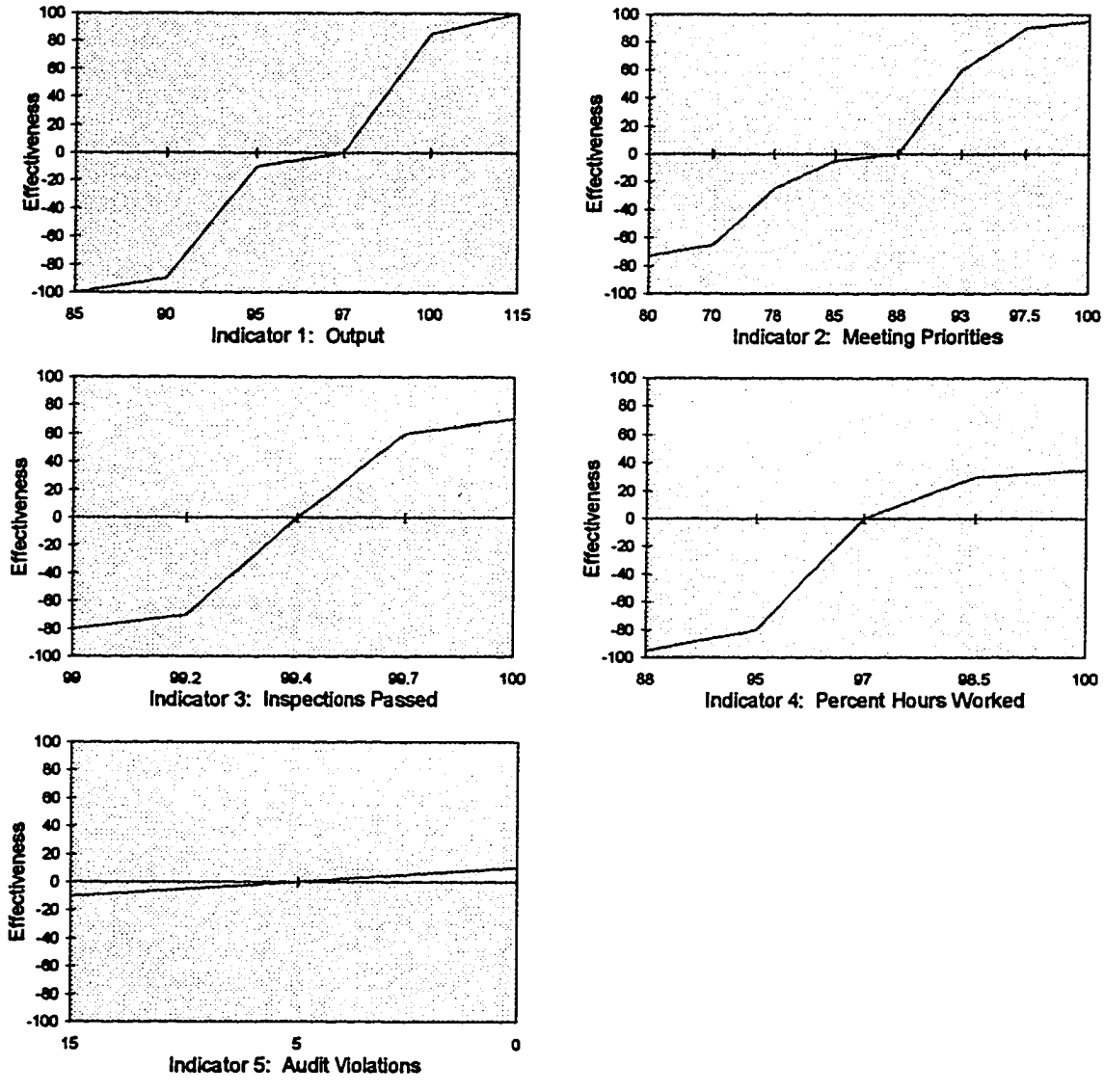

Figure 1. Sample contingency set.

(positive value). An overall effectiveness score is also calculated by summing across all of the indicators. This overall score represents the unit's overall effectiveness. Consequently, unit personnel (and management) can readily determine how well they are meeting organizational objectives. Historical information (such as the change in each indicator from the previous to the current work period and/or a plot of the overall effectiveness over time) is also usually included in the feedback report. This information is used by management and unit personnel to formulate and evaluate strategies designed to improve performance.

Giving and Responding to Feedback

The final step in the ProMES process is to review the information presented in the feedback reports. Using the feedback reports as the basis of discussion, meetings between supervisors and unit personnel are then held to review the unit's performance and to devise improvement strategies where needed.

Combining Information From ProMES Studies

The most popular method for combining information across studies is a meta-analysis (Hunter & Schmidt, 1990), a technique which purportedly provides a number of advantages over more traditional narrative reviews (Glass, McGraw, & Smith, 1981; Green & Hall, 1984; Hunter & Schmidt, 1990). For example, proponents of meta-analysis contend that it potentially provides a more comprehensive review of the literature because it typically includes the majority of studies related to a particular topic. In contrast, a narrative review

usually includes only a subset of the relevant studies. Thus, meta-analyses potentially have greater external validity. Other advantages include:

1. A larger number of studies can be included with less effort, thus, meta-analyses are potentially more efficient.
2. The focus of meta-analyses on the magnitude of the effect provides more useful information in understanding the relationship between variables than simply focusing on significance testing.
3. The focus of meta-analyses on effect size also overcomes the limitations of significance tests with respect to small sample sizes.
4. Meta-analytic procedures allow the reviewer to control for statistical artifacts.
5. Meta-analyses are less prone to Type I errors.
6. Meta-analyses provide a more standardized method of summarizing a given body of literature.

Consequently, proponents for the technique contend the greater scientific rigor combined with the above-mentioned advantages allows a researcher to be more confident of the conclusions drawn from a meta-analysis.

Unfortunately, though the proponents of meta-analysis have claimed it is superior to the traditional narrative review, others (Guzzo, Jackson, & Katzell, 1987; Orwin & Cordray, 1985; Wanous, Sullivan, & Malinak, 1989) argue that some of the advantages may be more illusory than real. For example, one of the main misconceptions about meta-analysis is that the technique is much more objective than narrative reviews. A closer examination of the procedure reveals, however, that there are many subjective decisions made during the course of a meta-analysis. These include determining which variables to consider, the actual coding of these variables, which method to use to estimate

effect sizes, which artifacts to control for, and so forth. As such, the technique is in fact very subjective. Evidence for this was provided by Wanous et al. (1989), who demonstrated that many of the differences in conclusions drawn from different meta-analyses in a given topic area can be attributed to differences in the judgment calls on coding variables and the methods used to interpret the findings.

However, although meta-analysis cannot automatically be assumed to be superior to other types of reviews in all situations, it strengths can outweigh its weaknesses if adequate information is provided in the primary studies. One of the largest obstacles faced by researchers attempting to conduct a meta-analysis is the lack of information reported in the primary studies. Insufficient information can either increase the subjectivity in the meta-analysis or it can result in the study being dropped from the analysis. In the present study the primary researchers coded their own studies and provided all the raw data, which helps ensure adequate information on each study. Consequently, this should not be a limitation of the present study.

Research Questions

The purpose of this study was both exploratory and confirmatory in nature. Specifically the study attempted to answer the following questions concerning ProMES:

Exploratory analyses:

1. What effect does ProMES have on productivity improvement?

2. What factors external to the intervention process (e.g., country, type of worker) influence the effectiveness of ProMES?

Confirmatory analysis:

3. Can variability in the effect of ProMES be explained by variability in the informational value provided by ProMES feedback over feedback provided prior to ProMES?

The following sections will elaborate on each of these research questions by explaining the question, reviewing the relevant literature, and indicating how the question is related to ProMES interventions.

Question 1. What Effect Does ProMES Have On Productivity Improvement?

Guzzo, Jette, and Katzell (1985) estimated that the mean effect size for all psychologically based interventions on productivity is .63. The average effect of feedback on productivity was calculated to be .35 overall, and .41 for output measures. In contrast, Pritchard (1995) reported that the average effect size of ProMES on productivity was 2.3. This estimate was based on productivity data from 26 groups reported in a book of ProMES case studies edited by Pritchard (1995). This effect size is impressive compared to the effect sizes reported by Guzzo et al. (1985) as well as Cohen's (1977) contention that an effect size of .8 is large.

The present study has the potential to provide a more accurate estimate of the impact of ProMES for several reasons. First, the current study based the estimate on a larger sample of cases (i.e., 43 cases). Second, it is possible that the use of Cohen's *d* in previous ProMES projects systematically

underestimated the effect of the intervention (Pritchard, 1995). The typical ProMES project contains a baseline period during which productivity data is collected at multiple times but no feedback is given to unit personnel. This is followed by a feedback period during which personnel regularly receive productivity information in the form of formal, written reports. In the past, the effect sizes were calculated by first subtracting the average productivity during the baseline period from the average productivity during the feedback period and then dividing this statistic by the pooled standard deviation of the two periods.

However, this procedure is only appropriate if the overall mean and standard deviations accurately represent their respective periods. Unfortunately this is not always the case. In many ProMES projects a plot of the overall effectiveness over time resembles a learning curve (see Figure 2). As the figure depicts, the overall effectiveness of the group increases sharply following the first feedback period, continues to climb for a period of time, and then begins to level off or plateau. The use of Cohen's *d* will systematically underestimate the full impact of the intervention in these cases by underestimating the mean difference in the numerator and overestimating the pooled standard deviation in the denominator. The distortion of both the numerator and the denominator are the result of using the entire feedback period to calculate the necessary statistics. For example, in Figure 2, the average effectiveness level for the baseline period is -29.88, and for the entire

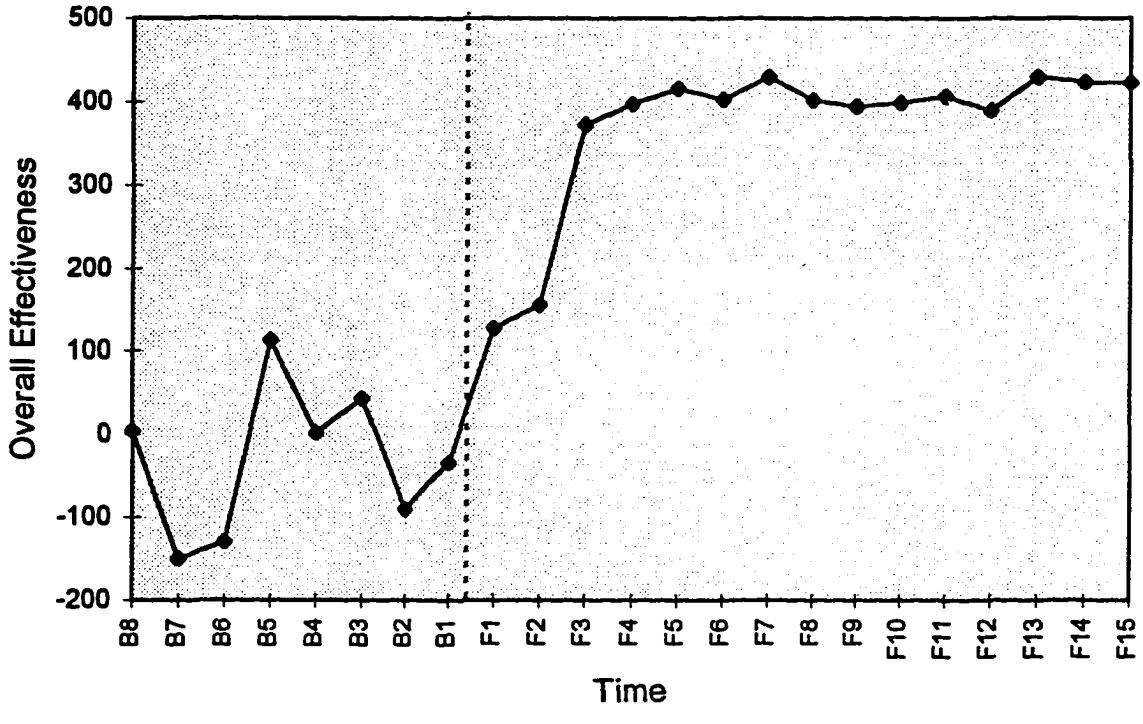

Figure 2. Sample plot of overall effectiveness over time.

feedback period is 371.60. The use of these 2 statistics would result in a mean difference of 401.48 in the numerator. The variances of these 2 periods are 7998.7 and 8964.54, respectively, which result in a pooled standard deviation of 92.94. The estimated effect size for this project would thus be 4.32.

Although 371.60 and 8964.54 are, in fact, the mean and variance of the feedback period, it takes time for the full impact of an intervention such as ProMES to take effect. Thus a better estimate of the actual impact of ProMES may only be revealed in the latter stages at the plateau of the feedback period.

If this is true, then what is needed is an effect size estimate that is calculated on the data after it has reached the plateau. This can be done by using the mean and variance of the plateau period (rather than the entire feedback period) in conjunction with those obtained from the baseline period. (We will refer to these effect size estimates as plateau-*d*'s.) For example, the mean productivity of the plateau is 409.75, and the variance of the plateau is 201.11. If these statistics are used to represent the intervention period, the mean difference in the numerator would now be 439.63 rather than 401.48, the pooled standard deviation in the denominator changes from 56.87 to 92.44, and the estimated effect size for this project would be 7.73 rather than 4.32. As such the use of Cohen's *d* would, in this case, seriously underestimate the true effect of the intervention. Consequently, it may be may be more appropriate to use plateau-*d* estimates in cases where there is an observable plateau in the data and Cohen's *d* when there is no plateau.

Finally, a number of researchers have questioned the appropriateness of comparing effect sizes obtained in projects using a repeated measures design with those obtained from other research designs (e.g., Dunlap, Cortina, Vaslow, & Burke, 1996; Kluger & DeNisi, 1996; Rodgers & Hunter, 1991). For example, Rodgers and Hunter (1991) contend that the use of *d* or *r* in meta-analysis is only appropriate when the design contains multiple elements (e.g., people) in two conditions. However, in almost all ProMES studies the project design is a one group repeated measures design with productivity measured at the group

level. In other words, instead of having multiple elements in two conditions, ProMES projects have a single element (i.e., a group) measured repeatedly over time in multiple conditions. As such, it is impossible to assign a mean or standard deviation based on individual elements.

In past research (e.g., Pritchard, 1995), means and standard deviations were based on samples of observations over time. Kluger and DeNisi (1996) argue that this may be inappropriate because the distribution of *d* is based on a sampling of elements (e.g., people) and not a sampling of observations in time. According to them, "there is no way to compare a sample of 100 points in time with a sample of 100 people [because] a sample of 100 points in time has the same degrees of freedom if it were based on an observation of 1 person or of 1,000 people" (p. 257). They recommend calculating a "quasi *d*" by transforming ARIMA *t*'s to *d*'s, and then weighting them by the number of participants involved in the primary study. This method is not a viable option for this study because ARIMA requires 50 data points per condition to adequately specify a model (Jones, Matt, Patton, & Reed, 1996), and ProMES studies typically do not have sufficient data points per condition to meet this requirement.

One potential solution to this problem was proposed by Rodgers and Hunter (1991). They suggested that a percent productivity estimate (PPE) rather than a *d* should be calculated with this type of data. This estimate simply compares pre-intervention productivity (baseline) with post-intervention

productivity (feedback). According to them PPE's are more appropriate with this type of data because PPE's do not suffer from any of the aforementioned psychometric issues associated with *d* statistics. As such, PPE's were also calculated for all cases involving group-level analysis over time.

Although there are no psychometric problems associated with calculating PPE's, they are problematic in that they are not directly comparable with the majority of effect sizes reported in previous research. This is important because if PPE's are an appropriate measure of time series designs and it can be shown that they are highly related with *d*'s calculated in these designs, it would provide evidence that the concerns regarding the use of *d*'s in time series studies might be unwarranted. As such, a high degree of similarity might allow comparisons between the effect sizes reported in past research and the *d*-statistics calculated in this study, and thus, allow for a more accurate estimate of the effect of ProMES relative to other interventions. For that reason, the similarity of results between the effect sizes calculated in this study was examined.

Question 2. What Factors External to the Intervention Process Influence the Effectiveness of ProMES?

The literature is filled with examples of factors external to an intervention which influence the impact of that intervention. These external constraints include individual differences in the personality of the recipients (Barrick & Mount, 1991; Day & Silverman, 1989; Ilgen, Fisher, & Taylor, 1979), the country

or culture in which the intervention was implemented (Erez & Earley, 1993; Hofstede, 1983; Kopelman, Brief, & Guzzo, 1990; Triandis, 1994), and the nature of the task (Kluger & DeNisi, 1996).

Although preliminary information indicates that ProMES can be successfully implemented in different settings, it has been impossible up to this point to identify factors external to the intervention process which may influence its effectiveness. However, the wealth of information provided by the primary researchers for the present study allows for greater quantification and subsequent examination of the possible factors responsible for the effect sizes associated with ProMES. For example, research has demonstrated that U.S. organizations manage their human resources very differently than organizations in other countries (Kopelman et al., 1990). A consequence of this difference is the lack of success of many U.S. practices in other countries (Ricks, Fu, & Arpan, 1974; in Ronen, 1986). Therefore, it is reasonable to expect that the impact of ProMES, which was developed in the U.S. and based on research predominantly conducted in the U.S., might vary across countries.

The potential moderating influence of several factors regarding the target unit were also examined in the present study. These included the type of worker (e.g., managerial, blue-collar) which described the majority of people in the target unit, the amount of formal education completed by unit personnel, and the size of the target unit (i.e., number of workers).

Question 3. Can Variability in the Effect of ProMES Be Explained by Variability in the Informational Value Provided by ProMES Feedback Over Feedback Provided Prior to ProMES?

Feedback is one of the cornerstones of ProMES, and the quality of information that is provided by the system is credited with much of the gains that result from using ProMES (Pritchard, 1990, 1995; Pritchard & Watson, 1991). In fact, although it has been demonstrated that system development alone can result in increases in productivity (Paquin, Jones, & Roth, 1992), the average effect of system development alone (.70) pales in comparison to the 2.3 effect size, which is associated with the introduction of ProMES feedback (Pritchard, 1995). Corroborating evidence for the importance of feedback in ProMES systems is demonstrated in a project conducted by Janssen, van Berkel, and Stolk (1995). In this project productivity increased when feedback was introduced, however, it began to decline when feedback stopped as a result of a breakdown of the computerized management information system. Productivity levels quickly rose again once feedback was resumed. This suggests that the feedback component of ProMES is, in and of itself, an important component of the increases in productivity attributed to ProMES.

Feedback Literature and Implications for Performance Improvement

There are many theories as to how feedback improves productivity. Some theorists believe that feedback provides information concerning the type, degree, and direction of errors in work behavior which leads to increased role

clarity (Rizzo, House, & Lirtzman, 1970, Pritchard, 1990, 1995) and the development and evaluation of strategies to correct these errors (Becker, 1978; Pritchard, 1990). The effect of feedback on productivity has also been attributed to the influence of feedback on worker motivation (Becker, 1978; Deci, 1975; Hackman & Oldham, 1975, 1976; Pritchard, 1990, 1995; Naylor et al., 1980). For example, theories which focus on the attainment of higher order needs for self-actualization and self-esteem (e.g., Maslow, 1954) contend that feedback increases motivation by creating an environment which allows individuals to satisfy higher order needs through task accomplishment (Ilgen, et al., 1979). Expectancy theorists argue that effort-to-performance expectancies are a strong determinant of motivation (Campbell & Pritchard, 1976; Vroom, 1964). Feedback can lead to improvements in these expectancies, thereby enhancing motivation and improving performance.

A similar relationship is supported by NPI theory. According to NPI theory (Naylor, et al., 1980), motivation is maximized if workers see clear connections between: (a) their behavior and the results, or "products," of their behavior; (b) their products and their evaluations; and (c) their evaluations and desired outcomes. Feedback can help individuals see the results of their behavior which clarifies the act-to-product relationship (Pritchard, 1990). Feedback, if it is evaluative, can also strengthen the perception of the product-to-evaluation relationship. Clarifying these relationships should lead to improved motivation.

Even though there are different theories about the relationship between feedback and productivity, the importance of feedback in the work environment has been recognized by many researchers (e.g. Deci, 1975; Hackman & Oldham, 1975, 1976; Katz & Kahn, 1978; Meyer, Kay, & French, 1965; Taylor, Fisher, & Ilgen, 1984), and has been a popular topic in journals for a very long time (e.g., Wright, 1906; in Kopelman, 1986). This popularity has lead to feedback being the subject of a number of reviews over the years (Adams, 1968; Ammons, 1956; Annett, 1969; Bilodeau, 1966; Guzzo et al., 1985; Ilgen, Fisher, & Taylor, 1979; Kluger & DeNisi, 1996; Locke, Cartledge, & Koeppel, 1968; Sassenrath, 1975). A common theme running throughout most of these reviews is that feedback has a positive impact on performance. For example, according to a meta-analysis by Guzzo et al. (1985), the average effect size of feedback on productivity output is .41.

Although the preponderance of evidence indicates that feedback generally has a positive impact on performance, the strength and nature of this relationship varies considerably across studies (Kluger & DeNisi, 1996; Kopelman, 1986). For example, Kluger and DeNisi (1996) found that feedback interventions had a negative impact on performance in over one third of studies included in their meta-analysis. This variability has also been observed in ProMES projects (Pritchard, 1995). One possible explanation is that these observed differences are the result of differences in the "quality" or value of the feedback information provided to the workers. For example, feedback can

consist of a pat on the back by a supervisor, or it can be a detailed, quantitative description of a individual's job performance. The informational value contained in a pat on the back, in most cases, is substantially less than the value of a detailed, quantitative performance evaluation. Consequently, the variability in the literature on the effect of feedback on productivity should not be surprising.

In addition, feedback is a complex stimulus that can vary along a number of dimensions (e.g., frequency, sign, timeliness, etc.). The informational value of the feedback, to a large extent, will depend on the nature of the feedback along these dimensions. An individual's perception and response to the feedback will also depend upon the characteristics of the source of the feedback and characteristics of the individual (Ilgen, et al., 1979). Consequently, to assess the perceived value of the information provided by feedback one *should* assess the characteristics of the individual, the source, and the feedback itself. Unfortunately, assessment of recipient and source characteristics, while important, is beyond the scope of this study because of the limitations inherent in the data. The database does not contain enough information on individual characteristics to adequately assess individual differences. Also, it is extremely difficult to determine who exactly is the source of ProMES feedback because the information contained in the report is the result of the efforts of peers, supervisors, administration, and sometimes other

individuals who may contribute ratings (e.g., students, customers, inspectors). Consequently, this study focused on characteristics of the feedback itself.

The literature has identified a number of feedback characteristics which influence the effect feedback has on productivity. These include the feedback sign, timeliness, interpretability, frequency, and the amount of unique information it provides. The following sections will review the relevant literature concerning these characteristics.

Feedback sign. One argument for the effect of feedback on a performance is that it is the result of the recipient's evaluation and comparison of the feedback to a standard (Kluger & DeNisi, 1996). This comparison is referred to as the feedback-comparison standard. If the feedback identifies a discrepancy in the feedback-comparison standard, the recipient can react in several ways including rejecting the feedback or attempting to attain the standard through increased effort (Kluger & DeNisi, 1996).

One possible reaction to feedback-comparisons discrepancies is to reject the feedback. Feedback has to be accepted as credible in order for it to have a positive impact on performance (Ilgen, et al., 1979; Pritchard, 1990; Taylor, et al., 1984). Recipients will, at the very least, disregard feedback lacking credibility, and, at times, may try to sabotage the associated feedback system. The sign of the feedback has been identified as one of the main determinants of its perceived credibility (Ilgen, et al., 1979; Taylor, et al., 1984). Taylor et al. (1984) identified several studies which showed that, in general,

positive feedback is perceived as more credible than negative feedback (Snyder & Shenkel, 1976; Steiner, 1968; Stone & Stone, 1982). Kluger and DeNisi (1996) also reported a correlation of .24 between feedback sign and associated effect sizes.

One possible explanation for the relationship between positive feedback and perception of credibility is that it is a response of the recipient's psychological defense mechanism (Ilgen, et al., 1979). The argument is that positive feedback is more likely to enhance one's self-image and thus is more likely to be perceived as accurate. Negative feedback, on the other hand, is more likely to reduce one's self image. As such, recipients may be more likely to reject negative feedback because of their unwillingness to accommodate negative discrepancies in their self image. In sum, according to this line of reasoning, recipients in projects in which the feedback was positive should perceive the feedback as more credible, and thus, the feedback in these projects should have a greater impact on productivity.

Kluger and DeNisi (1996), in contrast, cite a number of studies (Anderson & Rodin, 1989; Campion & Lord, 1982; Kernan & Lord, 1991) which indicate that recipients of negative feedback are likely to exert *more* effort to close the feedback-comparison gap than recipients of positive feedback. If this is true, then there should be a negative relationship between feedback sign and productivity. They do, however, qualify this position by stating that increased effort should only occur in situations where the recipients believe that increased

effort will reduce the discrepancy. If recipients do not believe that increased effort will reduce the discrepancy they will most likely shift their personal resources away from the task and direct these resources toward other goals. This shift in resource allocation would then result in decreased performance. Support for this position can be found in the significant negative relationship between discouraging feedback and performance obtained by Kluger and DeNisi (1996).

Therefore, one might conclude that negative feedback, in general, is more likely to be rejected unless the recipient believes that he/she can reduce the feedback-comparison gap. ProMES feedback reports typically include positive, negative, and neutral subscores. That being the case, it is not enough to simply consider the overall sign of the report, one needs to consider which parts of the feedback report are emphasized to unit personnel. Feedback meetings can be used to identify and address problems and improve performance, or they simply can be an opportunity for attaching blame. Preliminary information (Pritchard, 1995) indicates that feedback meetings in ProMES projects can vary from one extreme to the other, which suggests that the perceived credibility of the feedback system may vary as well. Meetings which emphasize the negative aspects of the report will lead to a negative perception of the feedback even if the overall score is positive. This means that meetings characterized by negative behaviors should hurt the perceived credibility of the feedback. Conversely, feedback meetings characterized by

positive behaviors should improve the perceived credibility of the feedback, and thus, positively impact productivity.

Furthermore, even in situations where initial negative feedback led to increased effort, it is reasonable to assume that if this increased effort only resulted in additional negative feedback (i.e., feedback meetings were repeatedly characterized by predominantly negative behaviors) that recipients would likely perceive the feedback as discouraging. According to the literature, there is a significant, negative relationship between discouraging feedback and performance (r = -.31; Kluger & DeNisi, 1996). Consequently, one could conclude that repeated negative feedback would ultimately decrease the recipients belief that he/she could close the feedback-comparison gap, and thus shift resources away from the task. Therefore, once again, the sign of the feedback as measured by the dynamics of the feedback meetings, should be positively correlated to performance.

In summary, the literature indicates only credible feedback will positively impact performance and that the perceived sign of the feedback is an important determinant of its perceived credibility. Given this fact, it is important to include an estimate of feedback sign in the evaluation of the informational value of feedback. As such, the sign of the feedback was assessed and used in the present study as one of several criteria for estimating the potential informational value of ProMES feedback.

Timeliness of the feedback. The timeliness of the feedback refers to the amount of time between the individual's behavior and the receipt of feedback concerning that behavior (Ilgen, et al., 1979). The general rule is that the longer the interval between behavior and feedback the weaker the relationship between feedback and performance (Ammons, 1956; in Ilgen, et al., 1979). There is some evidence, however, which suggests that the feedback-performance relationship may not be weakened with delays (Bourne & Bunderson, 1963; in Ilgen, et al., 1979). These researchers contend that the length of time feedback is delayed will not detrimentally affect the impact of the feedback provided that: (a) there are no activities that interfere with the recipient's ability to recall the behavior, and (b) the recipient is still able to associate the feedback with the behavior (Ilgen, et al., 1979).

In most work situations, however, there are many activities which occur between an individual's behavior and feedback regarding that behavior which could interfere with the potential usefulness of the feedback. Therefore, it is more likely that the timeliness of the feedback will affect the feedback-performance relationship. Longer delays between the end of a measurement period and the receipt of feedback reports should weaken the positive effect of the feedback.

In summary, the feedback literature suggests that the timeliness of feedback is important in most work situations. Consequently, because ProMES projects involve the use of feedback in work settings, it is reasonable to assume

that the timeliness of the feedback should play an important role in the effect of ProMES feedback on productivity. Thus, the timeliness of the feedback was also used to assess the potential informational value of the ProMES feedback.

Interpretability of feedback. The information contained in the feedback must also be meaningful to the recipient (Ilgen et al., 1979). In other words, the recipient must be able to understand the information. Based on personal experience with ProMES, one could hypothesize that most people would require some training to interpret the information contained in ProMES feedback reports. However, with adequate training, almost anyone, regardless of educational level, should be able to understand the feedback reports. This implies that projects where unit personnel were provided training in interpreting the feedback reports should, on average, find the reports more meaningful, thereby making the information more likely to produce a positive impact on productivity. For that reason, the amount of training was used as an estimate of the interpretability of the feedback and included in the assessment of the potential informational value of the ProMES feedback.

Amount of unique information. Another important characteristic of feedback is the amount of unique information it provides. Feedback should only impact performance if it provides an increase in valuable information to recipients over and above the information already available to them (Ilgen, et al., 1979). In other words, if a recipient is already receiving high quality feedback on his/her productivity, then the value of the feedback provided by a

new feedback system will be negligible, even if it is of high quality. As NPI theory suggests (Naylor et al., 1980), feedback which does not provide an incremental increase in informational value will not further clarify the connections between a recipient's Acts-to-Products-to-Evaluations-to-Outcomes, and, therefore, should not increase their motivation. Thus, there will not be improvements in performance.

Consequently, it is not sufficient to simply measure the informational value of the feedback itself. It is also necessary to assess the feedback relative to information available to the recipient prior to the introduction of the ProMES feedback. In the present study the informational value of the feedback provided to unit personnel prior to the introduction of ProMES was measured in addition to the potential value of the ProMES feedback. The potential value of the ProMES feedback was then compared to the prior feedback to estimate the amount of unique information provided by the ProMES feedback.

Frequency of feedback. A generally accepted principle is the more frequent the feedback, the greater the positive impact (Ilgen, et al., 1979). Ilgen et al. (1979), suggest that one explanation for this may be that the more frequent the feedback from a given source, the greater the perceived accuracy. The frequency of feedback in ProMES projects varies from once a week to every few months. According to the frequency of feedback principle, recipients in projects with weekly feedback should perceive the feedback as more credible than recipients in projects where feedback is disseminated less frequently.

However, Ilgen et al. (1979) caution that there is a difference between the sensing of feedback and the interpretation of it. More complex feedback may take longer to interpret, and thus take longer for it to be useful to the recipient. Consequently, because the feedback provided in ProMES systems is complex in nature, it is possible that the "more-frequent-the-better" rule may not always be applicable in ProMES projects. Also, because the nature of the jobs performed by unit personnel varies considerably across projects the optimal frequency of feedback quite likely will also vary considerably. For example, in a project conducted in a U.S. university, feedback on teaching effectiveness was provided after each semester, which is the natural job cycle in this setting. In this situation, it is unlikely that providing feedback on a weekly basis would be perceived as more valuable. However, weekly feedback may be the optimal frequency rate in a manufacturing setting where the job cycle may be only a few days. In a ProMES intervention the frequency of feedback is determined by people who actually perform the job (i.e., the design team), which suggests that it is very likely that the frequency of feedback is probably set at a level that is optimal for the nature of the job. Thus, the more-frequent-the-better rule does not appear to make sense with respect ProMES projects, and, as such, frequency of feedback was not included in the analyses.

Summary of Relationship Between Feedback and Productivity in ProMES Projects

Based on the feedback literature, the following relationship between feedback and productivity is proposed (see Figure 3). First, the Potential Informational Value of the ProMES Feedback will be a function of the perceived characteristics of the feedback (i.e., sign, timeliness, and interpretability). As mentioned earlier, the characteristics of the individual and source will also affect the informational value of the feedback, but it is beyond the scope of this project. The greater the informational value of the feedback the greater its potential impact on productivity. However, ProMES feedback should only impact productivity if it provides unique information beyond the information contained in the feedback provided to recipients prior to the introduction of ProMES. Larger increases in unique information value should lead to greater understanding of the relationships between Acts-to-Products-to-Evaluations-to-Outcomes. Increases in the clarity of these relationships should be positively correlated with motivation, which, in turn, should be positively related to subsequent increases in performance.

In summary, it is hypothesized that some of the variability in effect sizes observed in ProMES studies can be attributed to variability in unique informational value provided by ProMES feedback. Therefore, the following hypothesis is proposed:

Hypothesis: There will be a significant, positive relationship between the incremental increase in informational value provided by the ProMES feedback (over prior feedback) with changes in productivity.

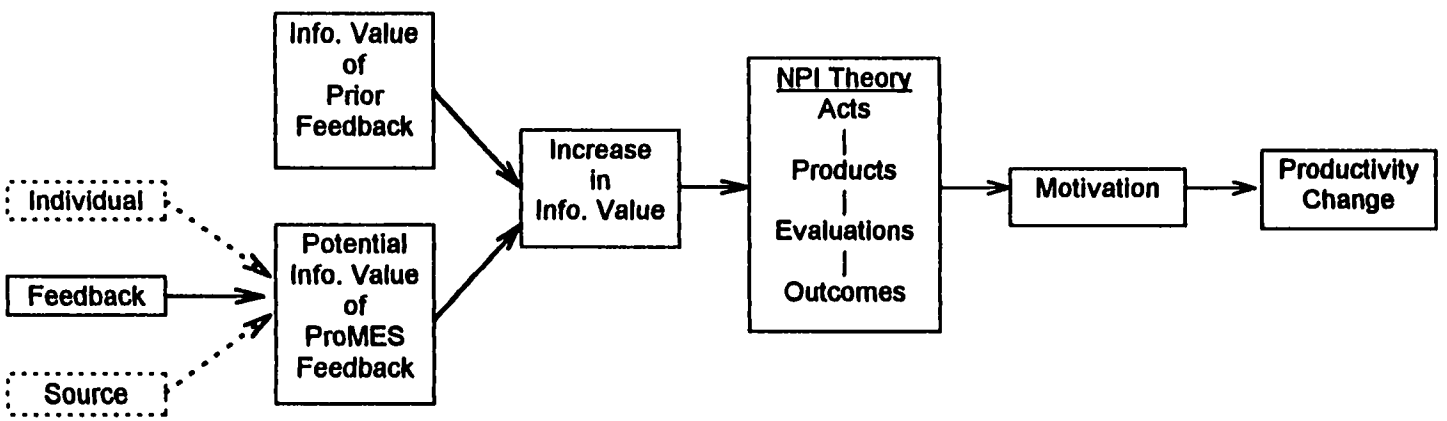

Figure 3. Conceptual model of the relationship between feedback and productivity change.

METHOD

Development of Database

The ProMES database was designed to contain information on all past and future projects conducted in the United States and abroad. The information currently stored in the database was provided by the researchers who supervised the projects.

The original list of variables included in the database initially came from several sources. First, the author and his advisor (R. D. Pritchard) independently drew up lists of potential variables that were important to the success/failure of ProMES projects based on their personal experiences with prior projects. Second, variables mentioned in the original ProMES book (Pritchard, 1990) and studies (Algera & Hurk, 1995; Bonic, 1995; Borg, Staufenbiel, & Pritchard, 1995; Hedley, Sawyer, & Pritchard, 1995; Howell, Jones, & Hood, 1995; Janssen, van Berkel, & Stolk, 1995; Jones, 1995a; Jones, 1995b; Jones & Ourth, 1995; Kleingeld & van Tuijl, 1995; Miedema, Thierry, & van Oostveen, 1995; Miedema & Thierry, 1995; Pryzgodda, Kleinbeck, Schmidt, & Beckmann, 1995; Roth, Watson, Roth, & Pritchard, 1995; Schmidt, Pryzgodda, & Klein, 1995; Watson, Hedley, Clark, Paquin, Gottesfeld, & Pritchard, 1995) described in Pritchard's (1995) book of ProMES case studies were added to the list of variables. Finally, an unpublished manuscript containing a list of variables associated with the design and implementation of ProMES (Schoonen, 1992), and a meta-analysis conducted by Guzzo, et al. (1985) were examined for additional variables. The resulting list of variables was then refined and items for measuring the variables developed. A rough draft of the survey instrument was then composed.

The author then met with ProMES researchers in the United States, the Netherlands, Germany, Sweden, Finland, and Israel to solicit their feedback on the development of the database. These researchers were asked to identify important variables that had not been included in the first draft, and to identify variables which should be dropped. They were also asked to comment on the items already included in the instrument, and to suggest items for measuring variables which were not, at this time, operationally defined.

A second draft of the instrument was then developed based on these interviews. This draft was then sent back to the researchers to solicit their feedback once again. Revisions were made to incorporate their suggestions, and a final draft of the instrument was developed (see Appendix B). A list of researchers who gave feedback on the database instrument can be found in Appendix C.

All ProMES researchers were provided with the instrument upon completion of the final draft. These researchers were then asked to complete the questionnaire and provide raw data and contingencies for all of the ProMES projects they conducted. This information will be entered into the ProMES database.

Calculation of Effect Sizes

All of the effect sizes to be used in this study require that the average baseline and/or average feedback productivity levels be calculated as well as the pooled standard deviation. In cases where the level of analysis is the individual, the necessary statistics were calculated across individuals in each of the conditions (i.e., baseline or feedback) consistent with procedures outlined in the literature (Dunlap et al., 1996; Schmidt & Hunter, 1990).

The typical ProMES project, however, involves a one group repeated measures design with productivity measured at the group level. With these designs the procedure used by Pritchard (1995) to calculate effect sizes will be followed. For these studies, the baseline period is comprised of a series of single data points collected over time which precede the introduction of feedback reports. The feedback period is comprised of a series of single data points collected over time which occur after the introduction of feedback. For example, assume productivity scores are available for an organizational unit for 5 months without feedback followed by 5 months with feedback (see Table 1). The average baseline productivity would be estimated by calculating the mean monthly productivity level for January through May (i.e., [85 + 80 + 72 +83 + 81] / 5 = 80.2). The average feedback productivity would be estimated in the same manner for the months of June through October (i.e., [92 + 95 + 97 + 98 + 97] / 5 = 95.8). The pooled standard deviation would then be determined by calculating sums of squares around the mean of each intervention, adding them together, and then dividing by the pooled degrees of freedom ($N_{baseline} + N_{feedback} - 2$).

Table 1

Sample Productivity Data

Condition	Baseline (No Feedback)					Feedback				
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug.	Sep	Oct
Productivity	85	80	72	83	81	92	95	97	98	97

Cohen's d

Effect sizes were calculated for each of the target groups with productivity data in the database using the following formula (Arthur, Bennett, & Huffcutt, 1995, p. 44; Hunter & Schmidt, 1990, p. 271):

$$d = (\bar{X}_{Feedback} - \bar{X}_{Baseline}) / S_{Pooled} \quad (1)$$

"$\bar{X}_{Feedback}$" is the mean overall effectiveness score during the feedback period, "$\bar{X}_{Baseline}$" represents the mean overall effectiveness score during the baseline period, and "S_{Pooled}" is the within-groups standard deviation (Guzzo et al., 1985). The *d* statistic is similar to Glass's Δ, with the exception that S_{Pooled} is used in the denominator of *d* instead of the standard deviation of the control group (i.e., baseline period) as proposed by Glass, McGraw, & Smith (1981).

Plateau-d

Plateau-*d*'s were calculated for all ProMES projects for which the changes in productivity during the feedback period exhibit an initial period of increase (or decrease) followed by a leveling off or plateau. The existence and parameters of a plateau in the data were determined through a visual examination of the effectiveness over time plots. The formula for calculating *plateau-d*'s was as follows:

$$d_P = (\bar{X}_{Plateau} - \bar{X}_{Baseline}) / S_{Pooled} \quad (2)$$

where "$\bar{X}_{Plateau}$" is the mean overall effectiveness score during the feedback period plateau, "$\bar{X}_{Baseline}$" represents the mean overall effectiveness

score during the baseline period, and "S_{Pooled}" is the within-groups standard deviation (Guzzo et al., 1985) of the baseline and plateau periods.

Percent Productivity Estimate

PPE's were calculated for all cases involving a one group repeated measures design with productivity measured at the group level. These estimates were calculated as follows (Rodgers & Hunter, 1991):

$$PPE = 100 * (X_{Feedback} - \bar{X}_{Baseline}) / \bar{X}_{Baseline} \quad (3)$$

where $X_{Feedback}$ is the productivity value for the last time period (e.g., if a study has 10 time periods in the feedback period, then $X_{Feedback}$ is the productivity level associated with the tenth time period), $\bar{X}_{Baseline}$ is the mean productivity level for the baseline period.

Corrections for Sampling and Measurement Error

Effect size estimates from the primary data were not corrected for sampling error standard meta-analytic corrections for sampling error are not applicable to most ProMES projects because in a typical ProMES study the level of analysis is a single group, not individuals, measured over a number of time periods. On the other hand, the standard meta-analytic correction for standard error is predicated on the assumption of a sampling of individuals (or elements) rather than a sampling of observations in time (Kluger & DeNisi, 1996). Under these circumstances, it is obvious that the typical ProMES study

does not lend itself to corrections for sampling error. Consequently, the estimates presented in the present study were not corrected for sampling error.

Rodgers and Hunter (1991), also advocate against correcting for measurement error because reliabilities usually cannot be assigned to productivity measures. If reliabilities cannot be estimated, it is not possible to correct for measurement error. Therefore, overall means and standard deviations were only calculated with the traditional, unweighted formulas.

Exploratory Analysis of External Factors

Analysis of factors external to the ProMES intervention process (i.e., country, number of personnel in target unit, type of worker, and amount of formal education completed by target unit personnel) was accomplished by calculating effect sizes, variances, and confidence intervals for the various levels of each factor. A moderator was identified by (a) an average effect size that varied across subgroups, and (b) an average subset variance that was lower than the variance of the entire dataset (Arthur et al., 1995).

Test of Hypothesized Relationship Between Unique Informational Value of ProMES Feedback and Productivity

Some of the constraints of this study (i.e., insufficient number of target units, measures of individual characteristics and NPI contingencies), preclude the testing of the full model presented in Figure 3. Consequently, the operational model in Figure 4 will be used to test the hypothesis that the variability in the

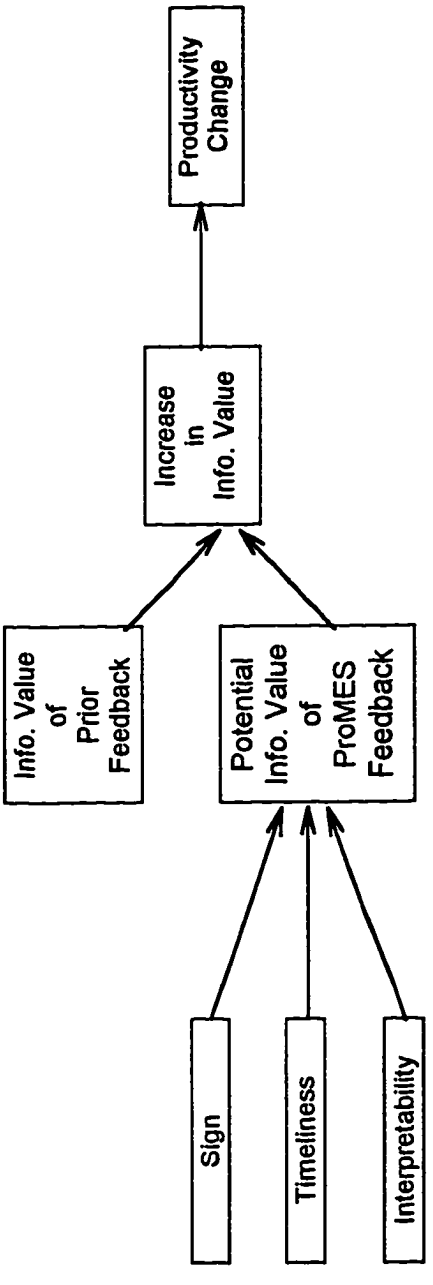

Figure 4. Operational model of the relationship between feedback and productivity change.

effectiveness of ProMES is the result of variability in the informational value of ProMES feedback over feedback provided prior to ProMES.

Potential Informational Value of ProMES Feedback

The "Potential Informational Value of ProMES Feedback" was estimated by combining information on the following feedback characteristics: sign, timeliness, and interpretability. The actual items from the ProMES database used to derive these estimates, and the rationale for their inclusion, will be outlined in the following sections.

Feedback sign. The sign of the feedback within each study was estimated through a composite score of two database items which describe the content of the feedback meetings (see Table 2). The percentage of time the feedback meetings were characterized by constructive and other positive discussion was divided by the percent of time spent in positive and negative discussion. The percent of time spent in irrelevant discussion was not included in the denominator because there is no way to determine the effect, if any, it might have on the perceived sign of the feedback. This percentage was calculated for each of the two items, and then the average of these two percents was used as the index of the sign of the feedback for a given case. This index captures the overall emphasis of the feedback meetings (i.e., whether positive or negative aspects of the feedback were emphasized), and thus, provides a measure of the perceived sign of the feedback.

Table 2

Database Items Used to Estimate Feedback Sign

Item #	Item
3.2.2.7	During initial feedback meetings what percent of the meeting time was characterized by the following behaviors? ____ Constructive feedback about performance ____ Constructive attempts to identify problem causes ____ Constructive attempts to develop improvement strategies ____ Irrelevant discussion ____ Blaming and searching for excuses ____ Other positive discussion. Explain: ____ Other negative discussion. Explain:
3.2.2.8	After experience with feedback meetings what percent of the meeting time was characterized by the following behaviors? ____ Constructive feedback about performance ____ Constructive attempts to identify problem causes ____ Constructive attempts to develop improvement strategies ____ Irrelevant discussion ____ Blaming and searching for excuses ____ Other positive discussion. Explain: ____ Other negative discussion. Explain

Timeliness. The timeliness of the feedback was calculated by dividing the average amount of elapsed time in days between the end of a measurement period and the personnel receiving a feedback report by the number of days in a measurement period. The resulting number was then transformed in two ways to be consistent with the other measures in this analysis. First, it was

reverse scored by subtracting it from one so that more timely feedback would be equated with higher numbers (i.e., the higher the number the better). Next, it was converted to a 100-point scale by multiplying it by 100. This was done so that it would be consistent with the percentages calculated to estimate the sign of the feedback.

*Timeliness = [1 - (Elapsed time / Measurement period length)] * 100* (4)

For example, suppose that the measurement period for a given organizational unit was 28 days and the average elapsed time between the end of a measurement period and personnel receiving a feedback report was 7 days. The timeliness index for this project would be [1- (7 / 28)] * 100 = 75.

This index captures the timeliness of the feedback relative to the normal job cycle (i.e., the measurement period). Including the job cycle in this estimate was important because what is "timely" for one job may be not be for another. For example, a manufacturing unit may have a normal job cycle of one week while in academia the normal job cycle is the semester (i.e., 15 weeks). The ramifications of manufacturing personnel receiving feedback three weeks after the end of a measurement period are quite different than for instructors in an academic department. Consequently, factoring in the normal job cycle created a more accurate estimate of the timeliness of the feedback than would have been obtained by simply using the number of elapsed days.

Interpretability. The interpretability of the feedback was estimated by one item in the database questionnaire which refers to the type of training received by unit members to interpret the feedback reports (see Table 3). Responses to this item were transformed to a 100-point scale to be consistent with the other indices used in this analysis. The transformation from a 5-point to a 100-point response format was as follows: 1=0, 2=25, 3=50, 4=75, 5=100. For example, if the response to this question was "3" (i.e., "The system and how it worked was explained to the entire unit in a meeting or other formal way," the "3" would be transformed to a "50."

Table 3

Database Items Used to Estimate Feedback Interpretability

Item #	Item
3.1.4.1	What type of training did members of the target unit receive to help them read and interpret the data in the feedback report?
	__ 5. The system was explained in great detail to the target unit and they were given examples of feedback data and how they were used. (Use this response if the entire unit was on the design team.)
	__ 4.
	__ 3. The system and how it worked was explained to the entire unit in a meeting or other formal way.
	__ 2.
	__ 1. No formal training was done other than the design team informally explaining the system to their peers.

The "Potential Informational Value of ProMES Feedback" was estimated by computing the average of the three scores associated with the sign, timelines, and interpretability of the feedback. This procedure was used rather than calculating a simple mean across all the items associated with the three feedback characteristics because of the different number of items used to estimate the characteristics. The literature does not indicate which of the three characteristics is more important, and, as such, it is best to weight the characteristics equally. However, timeliness and interpretability are estimated by only one item, whereas sign is a composite of two items. A simple mean would artificially assign more weight to sign of the feedback due to the larger number of items representing this feedback characteristic.

Informational Value of Prior Feedback

The "Informational Value of Prior Feedback" refers to the informational value provided by feedback prior to the introduction of ProMES feedback. Unfortunately, the same items used to estimate the "Potential Informational Value of ProMES Feedback" could not be used to estimate the value of *prior* feedback because the questionnaire did not require researchers to provide this information with regards to prior feedback. Consequently, the "Informational Value of Prior Feedback" was estimated by a composite score of three other database items (see Table 4). These items refer to the extent the job itself provided feedback to unit personnel, the degree to which supervisors or co-workers provided feedback, and the quality of the feedback given to the unit prior to ProMES. The composite score was calculated by first transforming the 5-point response formats of these items a 100-point format (i.e., using the same method as was used to transform the responses used to estimate

Interpretability) , and then calculating the mean of the three items. For example, suppose that for a given unit the scores for the three items were 2, 4, and 3. First, these responses would be transformed to 25, 75, and 50. The Informational Value of Prior Feedback for this unit would then be the mean of these three scores, which is equal to 50.

Increase in Informational Value

The "Increase in Informational Value" represents the amount of unique information provided by ProMES feedback beyond feedback provided to unit personnel prior to ProMES. This will be estimated by subtracting the "Informational Value of Prior Feedback" from the "Potential Informational Value of ProMES Feedback." For example, if for a given unit, the Informational Value of Prior Feedback is equal to 35 and the Potential Value of ProMES Feedback is equal to 50, then the Increase in Informational Value would be 50 - 35 = 15.

Table 4

Database Items Used to Estimate Informational Value of Feedback Prior to ProMES

Dimension	Item #	Item
Feedback from job	2.1.3.7	To what extent did the job itself provide group members with information about their performance? __ 5. Very much, the job was set up so that group members received almost constant feedback. __ 4. __ 3. Sometimes doing the job provided feedback to the group, sometimes it did not. __ 2. __ 1. Very little, the job itself provided almost no feedback, so the group could work forever without finding out how well they were doing.
Feedback from agents	2.1.3.8	The degree to which the employee receives clear information about his or her performance from supervisors or co-workers. __ 5. Very much, managers or co-workers provided group members with almost constant feedback about how well they were doing. __ 4. __ 3. Moderately, sometimes people gave feedback, other times they did not. __ 2. __ 1. Very little, people almost never let group members know how well they were doing.

Table 4 (Cont.)

Dimension	Item #	Item
Quality	2.2.1.5	Quality of performance/productivity feedback given to the target unit prior to ProMES. __ 5. Excellent __ 4. More than adequate __ 3. Adequate __ 2. Less than adequate __ 1. Poor

Note. More detailed explanations of these items are provided in the meta-analysis instrument (see Appendix B).

RESULTS

The Results section is divided into four parts. The first outlines the current status of the ProMES database. The second part includes preliminary calculations and comparisons of the effect sizes outlined in previous sections of this dissertation (i.e., Cohen's *d*, plateau-*d*, and PPE). The third part presents the results of the exploratory analysis on the relationship of variables external to the development process on the impact of ProMES. And the final section contains results regarding the influence of the incremental informational value of ProMES feedback on the success of a ProMES intervention.

Current Status of ProMES Database

Currently the database contains information on 44 organizational units from 7 different countries (Australia, Germany, Hungary, the Netherlands, Sweden, Switzerland, and the United States). The main functions of these units include manufacturing, service, education, and the military. The personnel in the target units range from blue collar workers to professionals, with from 9 to over 20 years of formal education. The units range in size from 3 to 50 individuals, and are located in both public and private-for-profit organizations. The local organizations (i.e., where the unit is physically located) range in size from less than 50 to over 1,000, with the parent organizations of the units ranging from less than 50 to over 100,000.

The database also contains information regarding various job-related, structural and psychological characteristics of the organizations, initial attitudes

towards productivity, descriptions of the system development process and resulting system, reactions to the system, and productivity data. However, not all contributing researchers were able to provide information on each of the approximately 150 to 200 variables contained in the database questionnaire. As such, the amount of information pertaining to each organizational unit varies considerably.

Response rates were not calculated for the present study for several reasons. First, copies of the questionnaire were sent to various ProMES researchers who, in turn, were asked to distribute them to other research teams who had conducted (or were conducting) ProMES studies. Thus, the number of individuals who actually received questionnaires was difficult to ascertain. Second, a number of the researchers who did receive questionnaires had been involved with multiple ProMES projects, and, as such, it is unclear whether the response rate should be calculated based on the number of researchers who responded or the number of studies for which they provided information.

Calculations and Comparisons of Effect Sizes

This section presents descriptive statistics for the effect sizes outlined in the Method section of this dissertation, and then compares these effect sizes to determine if they lead to the same conclusions regarding the effect of ProMES on productivity; and to decide which of the effect sizes is the most appropriate measure(s) to use in the ensuing analyses of potential moderating variables.

Results of Effect Size Calculations

The database contained productivity data for 44 organizational units. Cohen's *d*'s, plateau-*d*'s, and PPE's were calculated for all organizational units with appropriate data. The following sections contain the results of each of these calculations.

Cohen's d

A *d*-statistic was calculated for 43 of the 44 organizational units. A *d*-statistic could not be calculated for one unit because the database at present only contained productivity data for one baseline and one feedback period for this particular unit. The research design for 38 of the units was typical for most ProMES projects (i.e., a one group repeated measures design with productivity measured at the group level). Effect sizes for these units were calculated according to the procedure outlined in the Method section.

The remaining 5 units, however, contained individual-level productivity data measured over time. These units were part of a project in which ProMES was used to measure and improve teaching effectiveness. Each unit represented one of the departments in a college. An instructor's teaching effectiveness was evaluated using student ratings collected at the end of each semester. Because there were no teaching evaluations conducted prior to the ProMES intervention the first semester that an instructor was evaluated was used as the baseline. The rationale for this was that the first semester was taught without the benefit of any ProMES feedback. Effect sizes for these 5

studies were estimated by examining the differences between the first (i.e., baseline) and last semester evaluated. The last period was selected since it was felt that the last period would best represent the full impact of the intervention (Hunter & Rodgers, 1991). Effect sizes were then estimated according to the formula recommended by Dunlap et al. (1996) for experiments with repeated measures designs:

$$d = t\,[\,2\,(1 - r)\,/\,n\,]^{1/2} \qquad (5)$$

t = t-statistic for dependent groups, r = the correlation between the baseline and feedback productivity levels, and n = number of personnel. The mean effect size for these five units was .41.

Figure 5 contains the d-statistics calculated for each of the 43 organizational units. Several things are noteworthy about the data presented in this figure. First, a sizable majority of the effect sizes are positive. Second, approximately half of the effect sizes are larger than the .8 Cohen (1977) used to define a large effect size. Finally, there is a lot of variability across effect sizes.

The merit of statistical significance testing has recently been questioned by researchers such as Schmidt (1992) and Cohen (1994). One of the recommendations of these researchers is that some of the deficiencies of significance testing can be ameliorated by reporting effect sizes in the form of

confidence intervals. The argument is that confidence intervals contain all the information provided by significance tests (i.e., the status of the null hypothesis), plus information regarding the alternate hypothesis (Cohen, 1994). As such, 95% confidence intervals were also calculated for all effect sizes reported in this study.

Summary statistics across organizational units can be seen in Table 5. These statistics suggest that the average effect of ProMES on productivity as estimated by Cohen's *d* (1.20) is considerably larger than effect sizes reported for other interventions. However, due to the potential psychometric issues surrounding *d*-scores estimated in time series designs (e.g., Kluger & DeNisi, 1996; Rodgers & Hunter, 1991), comparisons with effect sizes reported for other types of studies should be interpreted with care. The large standard deviations and wide confidence intervals also provide evidence that the impact of ProMES on productivity varies considerably across organizational units.

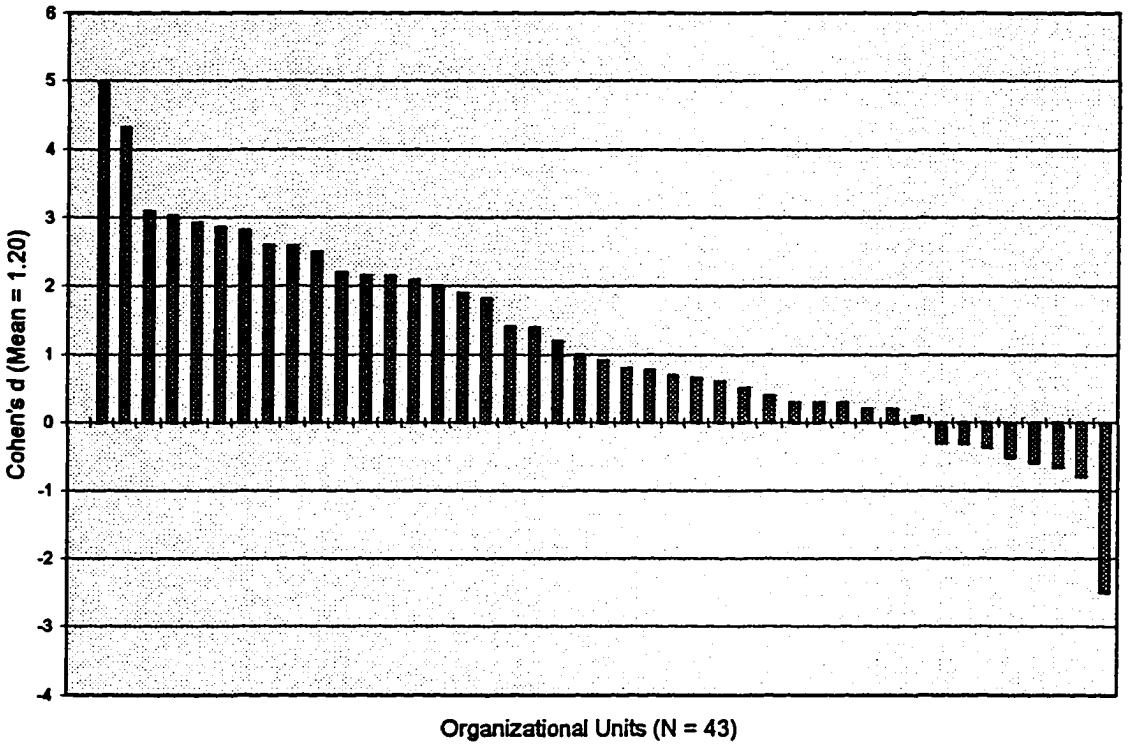

Figure 5. Cohen's *d* effect sizes across organizational units.

Table 5

Average ProMES effect size

Metric	k	Mean[a]	SD[a]	95% Conf. Interval	
Cohen's *d*	43	1.20	1.49	.75	1.65
Plateau-*d*[b]	12	4.04	2.22	2.78	5.30
PPE	39	172.43	438.50	34.81	310.05
$d_{Combined}$	43	1.65	2.20	.99	2.31

Note. [a]Unweighted means and standard deviations. [b]For 2 units Cohen's *d* = Plateau-*d*

Plateau-d

An examination of the effectiveness over time plots of the 44 organizational units with productivity data (see Appendix D) by the author revealed only 11 cases with observable plateaus. A second researcher reviewed the effectiveness over time plots and identified the same 11 cases but also identified an additional case that he felt possessed a plateau. The author and the second researcher reviewed this 12th case together and agreed that there was a plateau in the data. Consequently, a total 12 cases were identified as warranting the calculation of a plateau-*d* (see Appendix E). In two of the identified cases the "plateau" represented the entire feedback period, and, thus, the plateau-*d* was equal to the Cohen's *d* estimated for these groups.

Summary statistics for these estimates are also contained in Table 5. It is obvious from the data in this table that the mean plateau-*d* of these 12 cases is extremely large. The magnitude of these means is especially striking when compared to Cohen's (1977) criteria for large effect sizes (see Figure 6). However, once again, direct comparisons should be done with care until the psychometric issues surrounding time series *d*-scores are resolved. Other noteworthy aspects of these plateau-*d*'s are that they vary considerably across organizational units and that they are all positive.

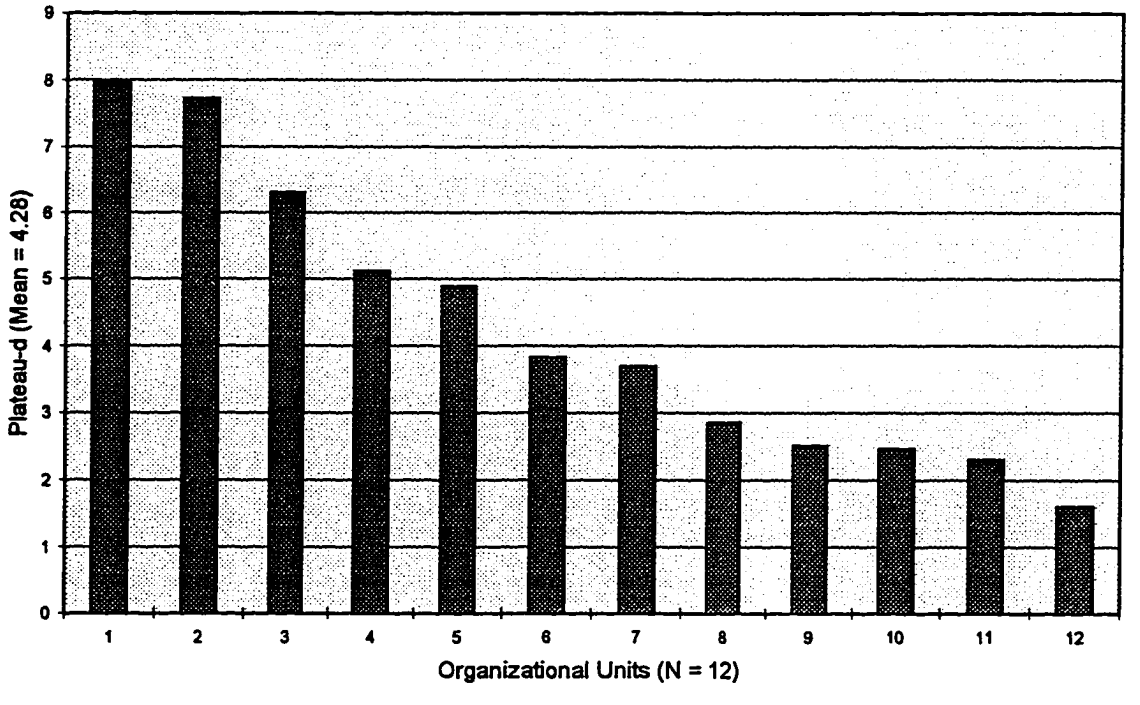

Figure 6. Plateau-*d* effect sizes across organizational units.

Percent Productivity Estimates

PPE's were calculated for 39 of the 44 organizational units. PPE's were not calculated for the 5 units containing individual data because PPE's were developed to be used in situations where individual data was not available and, thus, would be inconsistent with the intended purpose for its use (Rodgers & Hunter, 1991).

Summary statistics associated with PPE estimates can be found in Table 5. Although the mean effect size for these effect sizes is extremely large, the most striking aspect of these results is the magnitude of the variance across organizational units. This is reflected in the size of the confidence intervals, and the bar chart depicted in Figure 7.

Comparison of Effect Sizes

Comparison of descriptive statistics. An examination of the descriptive statistics provided in Table 5 reveals that all three of the effect size estimates outlined in the Method section (i.e., Cohen's *d*, plateau-*d*, and PPE) essentially show the same pattern of results. More specifically, the mean effect size for each estimate is extremely large as is the variance around the mean. Pearson correlations were calculated between the three effect size estimates to more accurately ascertain the degree of congruity (see Table 6). Although based only on 12 data points, the results indicate that Cohen's *d* effect sizes were significantly correlated with both Plateau-*d*'s and PPE's, but, PPE's were not significantly correlated to plateau-*d*'s.

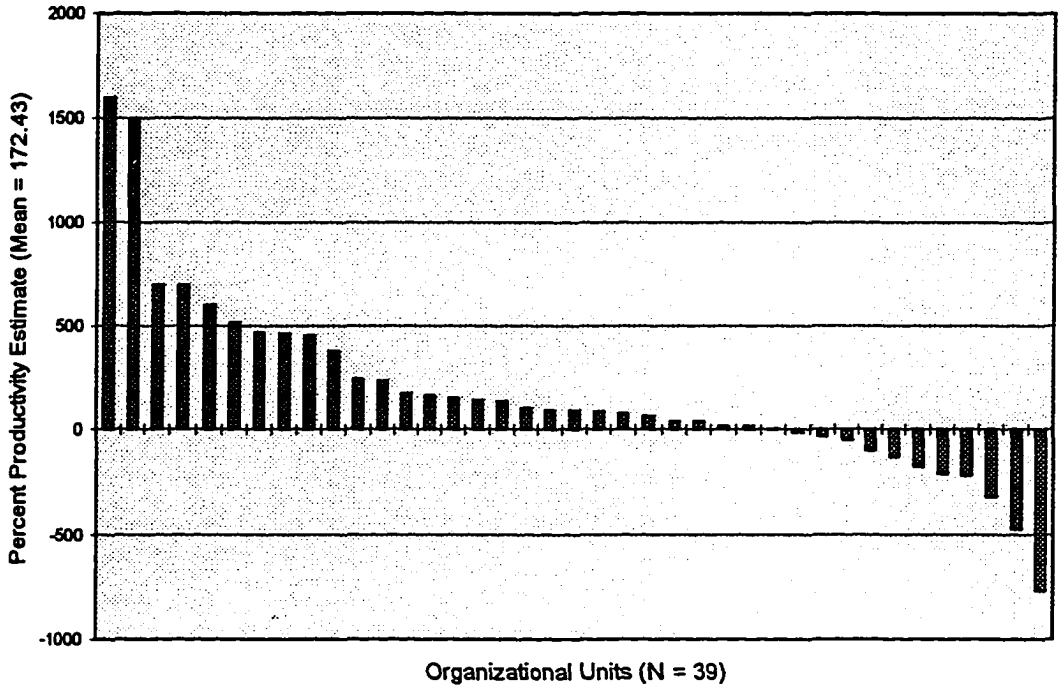

Figure 7. Percent Productivity Estimates across organizational units.

Table 6

Pearson Correlation Matrix of Effect Sizes

	Cohen's *d* (k)	Plateau-*d* (k)	PPE (k)
Plateau-*d*	.82* (12)		
PPE	.55* (38)	.54 (12)	
$d_{Combined}$	.93* (43)	1.00* (12)	.57* (38)

*$p \leq .001$

Determination of most appropriate effect size

It was decided that the use of all three effect sizes in the ensuing moderator analyses would be problematic for a couple of reasons. First, it would be difficult to interpret the moderator analyses if the various effect sizes yielded different patterns of results. Second, and more importantly, an examination of the descriptive statistics and correlations between the effect sizes revealed that certain effect sizes might be more appropriate than others. Consequently, the strengths and weaknesses of the various effect sizes were examined in light of the reasons for their initial inclusion in the present study.

The first two effect sizes examined for possible inclusion in the ensuing moderator analyses were Cohen's *d* and plateau-*d*. The relationship between these effect sizes is quite high (see Table 6). Nonetheless, this is confounded by the fact that all of the data used in computing the plateau-*d* was also used in estimating Cohen's *d*. It is further confounded by the fact that in two of the 12 cases the plateau-*d* is equal to the Cohen's *d*. However, the inclusion of plateau-*d*'s in this study was not to see if they were comparable to Cohen's *d*'s. Rather, they were calculated because it was proposed that while Cohen's *d* was a reasonable estimate of effect with some units, a plateau-*d* would be a better estimate with units where the data exhibited a leveling off period in the latter stages of the feedback period. Consequently, plateau *d*'s were used as the effect size for units exhibiting plateaus (n = 10), while Cohen's *d*'s was used for all others (n = 33). This effect size estimate will be referred to as $d_{Combined}$.

The average effect of ProMES on productivity as measured by $d_{Combined}$ was 1.65 (see Table 5). The differences associated with using $d_{Combined}$ versus Cohen's *d* can be seen in Figure 8. In this figure, each vertical column represents the data for the same organizational unit. The $d_{Combined}$ effect sizes were arranged in descending order and the corresponding Cohen's *d*'s for each unit was plotted directly above or below it. For example, the organizational unit with the highest $d_{Combined}$ was unit # 001-001-003. The $d_{Combined}$ for this unit was 7.97 and the Cohen's *d* was 4.98. Because the $d_{Combined}$ scores were plotted in

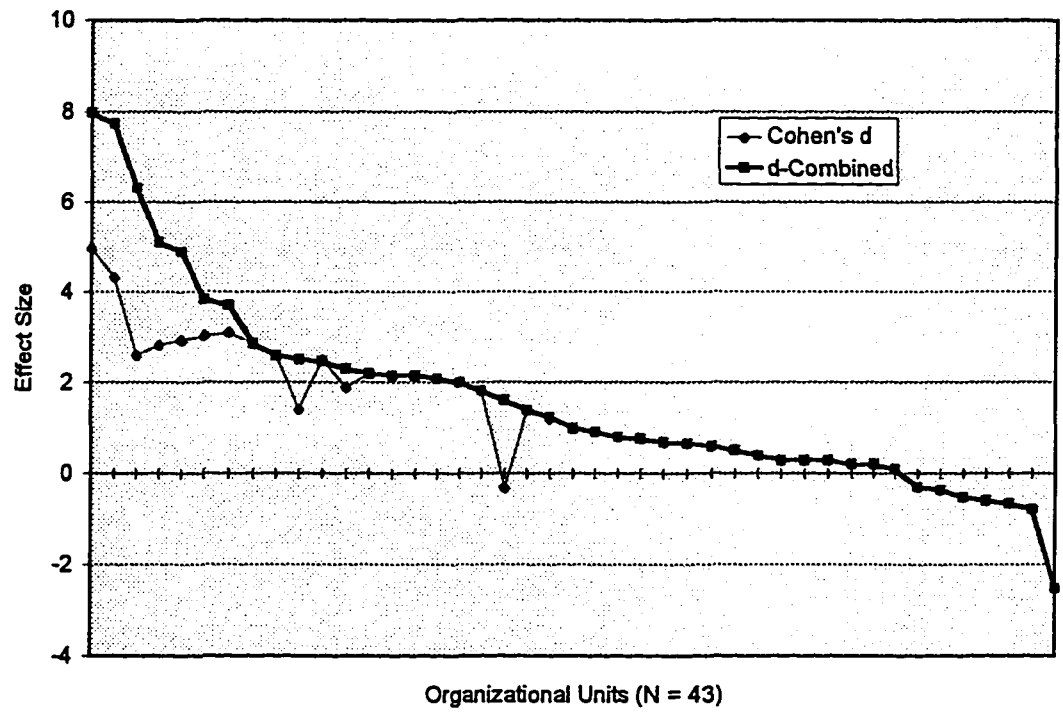

Figure 8. Comparison of $d_{Combined}$ and Cohen's *d* across organizational units.

descending order, the data point for this unit is the first one on the left. The corresponding Cohen's *d* for this unit is the data point directly below it.

A couple of things are noteworthy about Figure 8. First, deviations in the two plots represent the use of a plateau-*d* rather than Cohen's *d* to estimate the effect of the intervention for a given organizational unit. Second, in all instances, the plateau-*d* was larger than the Cohen's *d*.

The remaining effect size for consideration was the PPE. This estimate was included in the present study because the literature indicated that it did not suffer from the potential psychometric shortcomings associated with the use of Cohen's *d* for time series designs. As such, it was hoped that a high degree of similarity between PPE's and *d*'s would allow for *d*'s calculated in time series studies to be compared to those calculated in studies utilizing other research designs. Unfortunately, while the correlation between Cohen's *d* and PPE was statistically significant (see Table 6), the relationship between the two measures was not close enough to allow for direct comparisons between PPE and *d*'s. This conclusion is well illustrated in Figure 9, which compares PPE estimates relative to Cohen's *d* (top half) and $d_{Combined}$ (bottom half) effect sizes calculated for each organizational unit. In this figure, the *d* scores were arranged in descending order and the corresponding PPE for each unit was plotted directly above or below it. As this figure shows, although the correlation between the PPE estimates and *d* scores were statistically significant, the conclusions one draw regarding the impact of ProMES on productivity in many

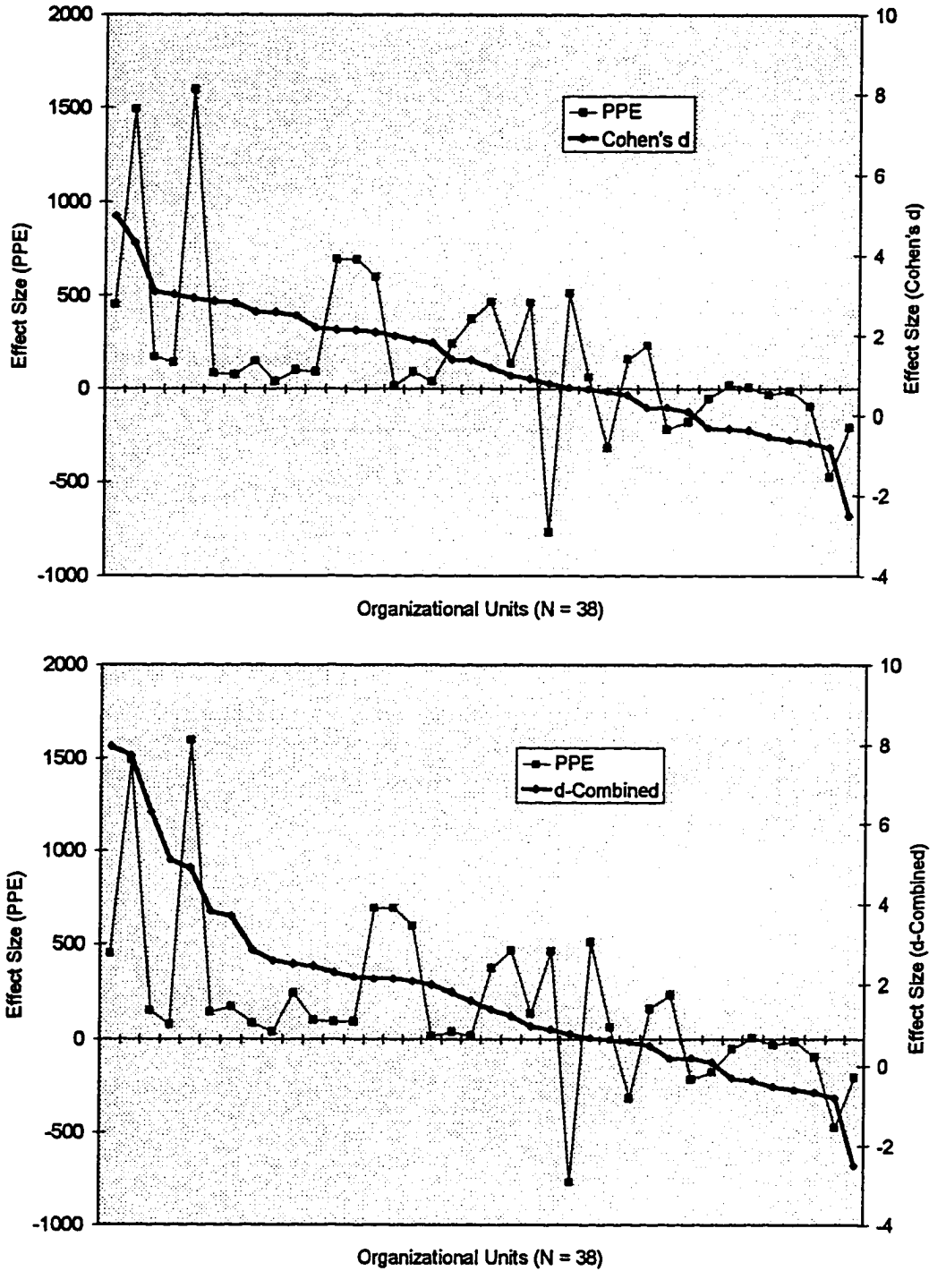

Figure 9. Comparison of *d*-scores and PPE's.

instances would be radically different depending which estimate was used in the analysis.

After examining these results we believe that PPE's should not be included in the subsequent analyses. First, the logic underlying PPE estimates is that the best representation of the full impact of the intervention is the data associated with the longest time frame (Rodgers & Hunter, 1991). However, in typical ProMES projects this is represented by a single data point which makes it extremely sensitive to chance fluctuations. Also, unlike studies where there is a definite end to the intervention period, the last data points in the database are simply the most recently available data point, and may not accurately represent the culmination of the intervention. Theoretically, using this single data point to represent the full intervention impact could still be appropriate in situations where the data exhibits a constant trend (upward or downward) or, at the very least, if the variance of the intervention period is fairly small. This type of situation is best represented in the database by those units exhibiting a plateau in their productivity growth. Therefore, one might expect that the relationship between the PPE and plateau-*d* estimates for these units should be fairly high. Unfortunately, as can be seen in Table 6, the correlation between these two measures was only .54. Finally, PPE's are not comparable to effect sizes reported in the majority of prior research. Consequently, while it was initially hoped that PPE's could prove useful in this study, because of their extreme

sensitivity to chance fluctuations and lack of comparability to other measures, they were not used in the following analyses.

In sum, an examination of the merits associated with each effect size revealed that a combination of Cohen's and plateau-*d*'s ($d_{Combined}$) potentially provided the most accurate estimate of the effect of ProMES on productivity, and, as such, it was used in all of the subsequent analyses.

Effect of Factors External to the ProMES Process

Unweighted mean effect sizes and 95% confidence intervals were calculated to examine the impact of factors external to the ProMES process on the success of the project. The external factors examined included the country in which the organizational unit was located, the number and type of worker in the target unit, and the amount of formal education completed by unit personnel. The results of the analyses associated with these external factors will be described in the following sections.

Location of Organizational Unit

The first external factor that was analyzed was the country in which the target unit was located. The descriptive statistics associated with this analysis are contained in Table 7. First, it is important to note that the means vary across countries and the standard deviations for many of the countries are quite large. However, any interpretations of these is results are problematic because of the small sample sizes in all but two of the subgroups. To address this problem the countries were grouped by continent and the data was re-analyzed.

The results of this analysis are contained in Table 8. The most interesting results of this analysis are that the mean effect is larger and the variance is substantially smaller in Europe than in the North America (i.e., U.S).

Number of Personnel In Target Unit

An examination of the relationship between the number of personnel in the organizational unit and impact of ProMES yielded a correlation of $r = -.47$ ($p=.006$, $n=34$) which suggests that ProMES works better with smaller organizational units.

Table 7

Mean Effects by Country

Country	k	$d_{combined}$	SD	95% Conf. Interval	
Overall	43	1.65	2.20	.99	2.31
Switzerland	1	2.59	--	--	--
Germany	3	2.52	.33	2.15	2.89
Hungary	1	1.82	--	--	--
Netherlands	13	1.78	1.71	.85	2.71
Australia	2	1.73	1.03	.30	3.16
USA	21	1.46	2.82	.25	2.67
Sweden	2	.85	1.08	-.65	2.35

Table 8

Mean Effects by Continent

Continent	k	$d_{combined}$	SD	95% Conf. Interval	
Overall	43	1.65	2.20	.99	2.31
Europe	20	1.84	1.46	1.20	2.48
Australia	2	1.73	1.03	.30	3.16
N. America	21	1.45	2.82	.24	2.66

Type of Worker

The possible moderating influence of the type of workers which comprised the target unit was also examined. The types of workers represented in the database included professionals (e.g., managers, accountants, academics), blue-collar/laborers (e.g., painters, dock workers, non-skilled labor), technicians (e.g., photocopier repairmen, nurses) and clerical/office workers. The results of this moderator analysis also revealed mean subgroup differences and large variances (see Table 9).

Amount of Formal Education

The last external factor to be analyzed was the amount of formal education possessed by the typical worker in the target unit. Formal education was defined as primary school, secondary school, vocational school, high

Table 9

Mean Effects by Type of Worker

Worker Type	k*	$d_{combined}$	SD	95% Conf. Interval	
Overall	43	1.65	2.20	.99	2.31
Technician	6	2.18	1.68	.84	3.52
Blue collar/Labor	20	1.66	2.74	.46	2.86
Clerical/Office	4	1.00	1.08	-.06	2.06
Professional	6	.78	.91	.05	1.51

Note. The overall number of studies does not equal the sum across subgroups because information on type of worker was not provided for all projects.

school, university, master's program, doctoral program, etc. Formal training done by the unit's employers was not included in this measure. Descriptive statistics for this analysis are included in Table 10. The most noteworthy result in this table is the moderate but relatively stable mean effect size for target units comprised of individuals with more than 20 years of formal education. A more interesting result in the rudimentary beginnings of an inverted "U" that appears if this data is place in a bar chart (see Figure 10).

Table 10

Mean Effects by Amount of Formal Education

Amount of Education	k*	$d_{combined}$	SD	95% Conf. Interval	
Overall	43	1.65	2.20	.99	2.31
Less than 9 yrs.	0				
9 to 12 yrs.	18	1.70	2.85	.38	3.02
13 to 17 yrs.	6	2.39	1.58	1.13	3.65
18 to 20 yrs.	0				
More than 20 yrs.	5	.41	.21	.23	.59

Note. The overall number of studies does not equal the sum across subgroups because information on amount of education was not provided for all projects.

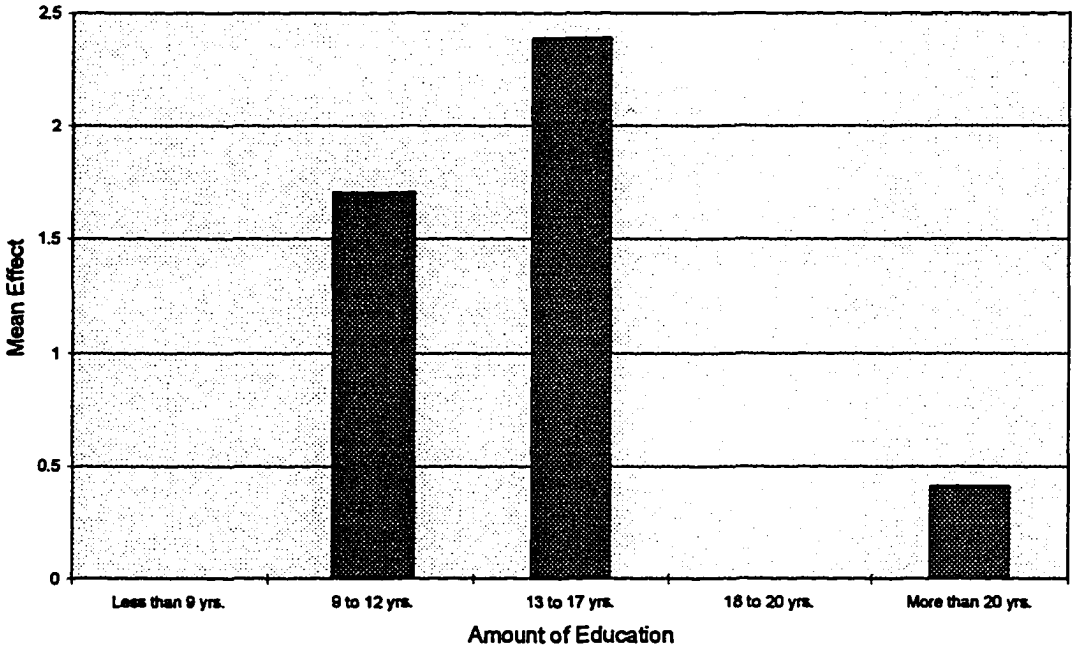

Figure 10. Mean effect size by amount of formal education.

Role of Informational Value of ProMES Feedback Over Prior Feedback

An examination of the 44 organizational units with productivity information revealed only 15 units containing all the necessary information required to estimate the incremental informational value provided by ProMES feedback over prior feedback. An analysis of the relationship between these increases in informational value and changes in productivity (i.e., effect sizes) yielded a correlation of .60 ($p = .018$) with a corresponding 95% confidence interval of .04 to .82 (Cohen & Cohen, 1983). To further clarify this relationship, units were split into bottom, middle, and top thirds according to the amount of incremental informational value that was provided by the ProMES feedback. Mean effect sizes and standard deviations were then calculated for each of these subgroups (see Figure 11). One interesting finding was the negative effect associated with the low subgroup. This finding suggests that feedback interventions which provide only a minimal amount of incremental informational value can have a negative effect on productivity.

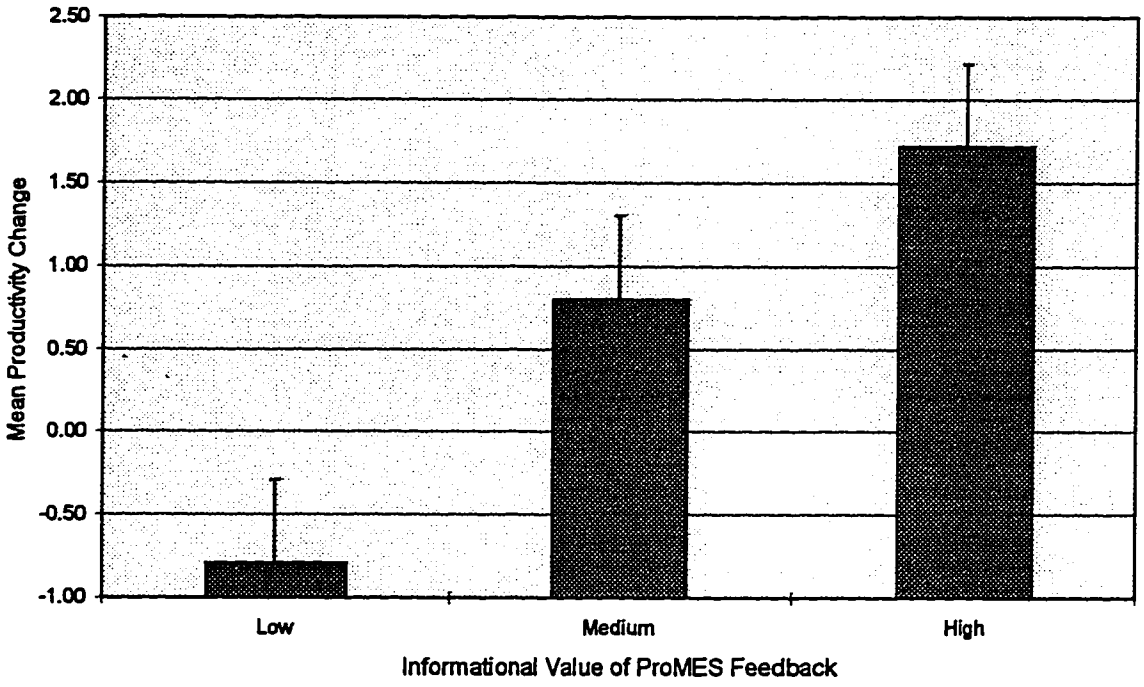

Figure 11. Productivity change by incremental informational value of ProMES feedback.

DISCUSSION AND CONCLUSION

The last chapter of this dissertation is divided into five sections. The first three sections address the three research questions which guided this project The next section discusses the limitations of the study, and the last section outlines implications and directions for future research.

Question 1. What Effect Does ProMES Have on Productivity Improvement?

One of the goals in this study was to identify an effect size that could provide an accurate estimate of the effect of ProMES. To this end, we examined the relative merits of two effect size estimates reported in the literature (i.e., PPE and Cohen's *d*), and one estimate that was created for the present study (plateau-*d*).

It was initially hoped that the PPE proposed by Rodgers and Hunter (1991) would provide an accurate estimate because the literature indicated that it did not suffer from the potential psychometric problems associated with the use of *d*-scores for time series designs. Unfortunately, the estimate's use of the last data period to represent the intervention proved to be problematic for two reasons. First, the last data period in the typical ProMES project is represented by a single data point (e.g., a monthly overall effectiveness score) which makes it extremely sensitive to random fluctuations. Second, the last data point associated with each target unit in the database is simply the most recent information available to the primary researcher when he or she completed the database questionnaire. It does not represent the culmination of the

intervention. As such, due to psychometric problems associated with applying PPE's to ProMES studies it was determined that they did not provide an accurate estimate of the effect of ProMES. Additionally, they were not comparable to most of the effect sizes reported in past research, and thus, were not used in subsequent analyses.

The second effect size estimate examined in the present study was Cohen's *d*. According to the literature there are potential psychometric problems surrounding the use of these estimates with time series designs (e.g., Dunlap et al., 1996; Kluger & DeNisi, 1996; Rodgers & Hunter, 1991). The most significant of these problems is the difficulty in determining if effect sizes obtained in time series designs are comparable with those obtained from other research designs.

In addition to these issues, it is also likely that Cohen's *d* systematically underestimates the effects of intervention in projects where the time series plots contain a leveling off, or plateau, in the intervention period. Plateaus are most likely an indication that it took a period of time for the intervention to take its full effect. The best estimate of the full impact of the intervention, therefore, is contained in this plateau. Cohen's *d*, however, introduces error into the estimate because it includes all of the data points leading up to the plateau. Consequently, these effect size estimates are also potentially problematic with respect to comparing effect sizes obtained across time series designs.

Plateau-*d*'s were introduced in the current study to address the shortcomings of Cohen's *d* with respect to projects with observable plateaus. Plateau-*d*'s provide more accurate estimates in these projects for two reasons. First, they allow time for the full impact of the intervention to take effect (Rodgers & Hunter, 1991). Second, because they are based on more than one data point (in contrast to PPE's), they achieve this benefit without extreme sensitivity to random fluctuations. The results indicated that using the "plateau" of the intervention period did consistently produce larger effect sizes in the expected direction (see Figure 8). More precisely, all observable plateaus were higher than baseline levels and, thus plateau-*d*'s should be higher than Cohen's *d*'s. Therefore we proposed calculating plateau-*d*'s for projects in which there were observable plateaus (either above or below baseline levels) and Cohen's *d*'s for the others (i.e., $d_{Combined}$)

The advantage of $d_{Combined}$ is that theoretically it should provide a more accurate estimate of the intervention effect. The potential disadvantage of $d_{Combined}$ is that, because it has not been used in previous research, it might be difficult to directly compare it with effect sizes previously cited in the literature. However, regardless of which estimate is used, essentially the same two conclusions are drawn with respect to comparisons with previous effect sizes. These are (a) time series *d*'s are considerably larger than most other effect sizes reported in the literature, and (b) comparisons with other effect sizes

remain problematic until the psychometrics issues surrounding time series *d*'s are resolved.

More specifically, the results of present study indicate that the mean effect size of ProMES on productivity is either 1.65 as measured by $d_{combined}$ or 1.20 if Cohen's *d* is used (see Table 5). Comparisons of either effect size with others found in the literature remain essentially the same. First, although the mean effect sizes in this study are considerably smaller than the effect size of 2.3 estimated by Pritchard (1995), they are both still substantially larger than the mean effect size of .63 reported by Guzzo, et al. (1985) for all psychologically based interventions and the .41 associated with feedback on output measures (Guzzo, et al., 1985) and performance (Kluger & DeNisi, 1996). Second, regardless of which effect size is used, although the results suggest that the effect of ProMES on productivity is considerably larger than those reported for other interventions, these comparisons remain problematic because of the aforementioned potential psychometric problems. Consequently, $d_{combined}$ was judged to be the better of the two estimates because, at least theoretically, it was a more accurate estimate, and that the increase in accuracy was achieved without any significant loss with respect to comparisons with previously reported effect sizes. Therefore, $d_{combined}$ was selected over Cohen's *d* for all subsequent moderator analyses.

Moderating Influence of Development and Implementation Process

Although the mean effect size of 1.65 is extremely large, the associated standard deviation of 2.20 is also large (see Table 6). This suggests that the impact of ProMES on productivity is moderated by one or more factors. Some potential moderators external to the development process were examined and will be discussed in the next section. However, an examination of the information contained in the database suggested a potential moderator that had not been previously considered for this study.

One item on the database questionnaire (see Table 11) asked the primary researchers to rate the similarity of the process they used to develop and implement ProMES relative to the original process described in Pritchard (1990). Information regarding this issue was available for 31 of the 43 organizational units used to estimate the average effect of ProMES (Mean $d_{combined}$ = 1.59). It was initially assumed that the majority of projects would have utilized the original ProMES process and, thus, this variable would be a constant rather than a potential moderator. Yet, it was discovered that the process used to develop and implement ProMES in more than half of the cases deviated from the original process. An attempt was then made to ascertain the consequences of these deviations.

Table 11

Database Item Used to Estimate Similarity of Process Used

Item #	Item
3.1.5.6	Overall, how closely did the development and implementation of the system in this setting match the process outlined in the 1990 ProMES book? __5. *Very closely.* That process was followed as closely as possible. __4. *Closely.* That process was followed with only minor changes. __3. *Moderately.* A few meaningful changes were made. __2. *Not closely.* Several substantial changes were made. __1. *Very differently.* Many substantial changes were made.

First, an examination of the relationship between the similarity of the process used and the resulting effect size was determined by calculating the correlation between the two variables. This procedure yielded a correlation of .64 ($p = .000$). This finding demonstrated that deviations from the original process did affect the impact of ProMES, but did little to reveal the amount of deviation required before significant differences occurred. In other words, would small deviations attenuate the impact of ProMES, or would this effect only be observed in cases where the process substantially deviated from the original? Consequently, to further clarify the relationship between these two variables, organizational units were grouped according to their similarity to the original ProMES development and implementation process, and mean effect sizes were calculated for each group (see Figure 12). As can be seen in the figure, the average effect size varies considerably across subsets. These

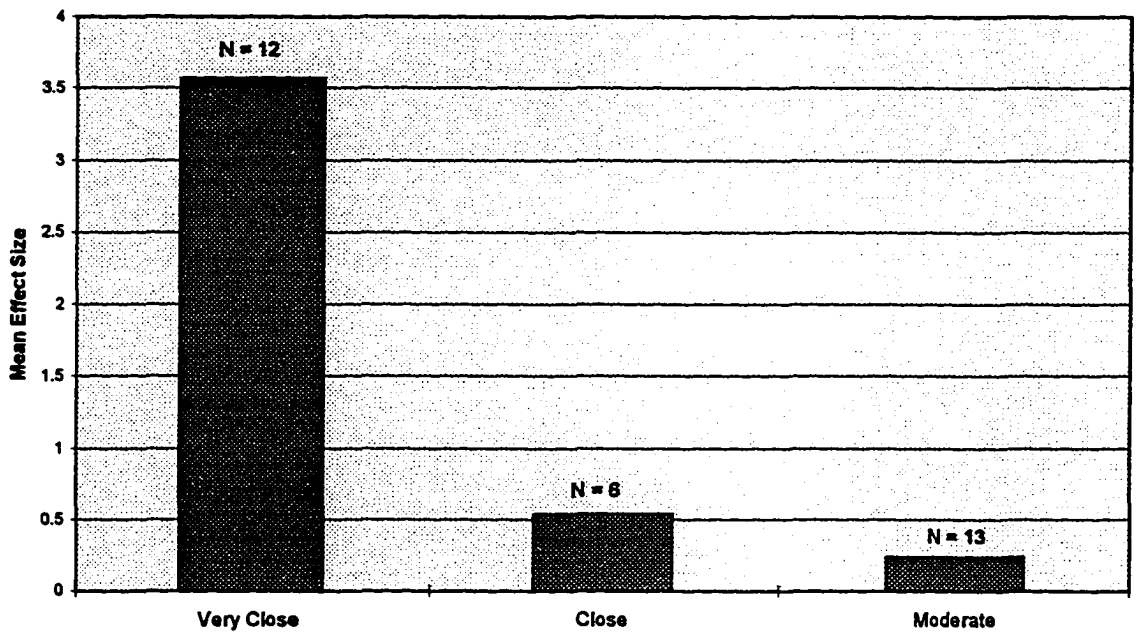

Figure 12. Closeness of development and implementation process used with original ProMES process. There are only three categories because no projects were rated as being "not close" or "very different" from the original process.

results strongly suggest that even slight deviations from the original process may significantly attenuate the effects of the intervention.

Although it is difficult at this time to specifically identify the deviation(s) causing the greatest attenuation, on a more general level, one of the most likely variables is the level of participation of target unit personnel in developing the system. An examination of the database revealed that a lower level of

participation was listed as one of the differences for all of the projects assessed as only moderately following the original process. In these projects at least part of the measurement and feedback system was developed by personnel outside of the target unit. For example, in one project objectives and indicators were developed at the local organizational level by a design team comprised of representatives from each of the five target units, after which, target unit personnel were given the opportunity to vote on the finished list of objectives and indicators. Target unit personnel then had the opportunity to serve on the contingency design teams. In several other projects, the entire system was developed in another unit, and target personnel were only allowed to modify some of the contingencies. It is possible that this lack of involvement negatively affected the validity and/or the perceived credibility of the system, and thus, negated much of the potential benefits of the intervention (Pritchard, 1990). In either case, unit personnel are likely to either reject the feedback or, possibly, try to sabotage the system.

Comparison of ProMES Effect Sizes to Other Effect Sizes

A simple examination of the changes in productivity following implementation of ProMES reveals that in most situations the change is positive and dramatic (see Appendix D). As these time series clearly indicate, productivity increased substantially over baseline with the introduction of ProMES feedback with the majority of organizational units. However, before a final conclusion can be drawn regarding the relative effect of ProMES with other

interventions, it should be noted, as several researchers (e.g., Kluger & DeNisi, 1996; Rodgers & Hunter, 1991) have proposed, that it is difficult to determine if effect sizes estimated in time series studies are directly comparable to effect sizes associated with other research designs. As such, care should be taken with regard to interpreting the impact of ProMES relative to other interventions by directly comparing effect sizes. There are, however, other more comparable sources of evidence which also provide some evidence regarding the impact of ProMES on productivity.

First, Kluger and Denisi (1996) found an expected base rate proportion of negative effects with feedback interventions to be 38%. However, an examination of the ProMES studies reveals negative effects in only 7 of the 43 organizational units; a proportion of only 16% (see Figure 8). This proportion, which is less than half of the proportion reported by Kluger and DeNisi, suggests that the impact of ProMES may be less likely to have a negative impact.

Second, in a meta-analysis regarding the impact of management by objectives (MBO) on organizational productivity, Rodgers and Hunter (1991) contended that the mean PPE of 44.6% reported in their study was "quite large" (p. 329). The mean PPE gain in this study was estimated to be 172.4%. Therefore, one could conclude that if the impact of MBO on productivity is "quite large," then the impact of ProMES on productivity is enormous.

In conclusion, although these sources are far from perfect, the conclusions drawn from these comparisons are consistent with the results obtained from the effect size estimates. Consequently, while the appropriateness of comparing the effect sizes calculated in time series designs is still unsettled, the answer to first research question seems to be that (a) the impact of ProMES on productivity appears to be extremely large regardless of the metric used to estimate its impact, and (b) that even slight deviations from the original development and implementation process can substantially attenuate the impact of the intervention.

Question 2. What Factors External to the Intervention Process Influence the Effectiveness of ProMES?

As indicated previously, the large standard deviation (2.20) associated with the mean effect size implies that there are one or more factors which moderate the impact of ProMES on productivity. An effort was made to determine if at least part of this variance could be attributed to certain factors external to the developmental process. Several conclusions were drawn from this analysis. First, an examination of the differences in mean effect sizes and standard deviations contained in Tables 7 through 11 suggests that any or all of the external variables examined may moderate the success of ProMES projects. Second, with few exceptions, the variance within the variable subgroups was still quite large, which suggests that there are multiple factors moderating the effect of ProMES. Finally, the number of cases within each of the subgroups is

too small to allow for the formation of any conclusive statements regarding the influence of external factors on impact of ProMES on productivity. Therefore the results of this analysis, and following discussions, are merely speculative and are only provided as a guide for future research.

Location of Target Unit

It is apparent from the results of this analysis that the average impact of ProMES varies across countries (see Table 7). However, the sample sizes for most of the countries were far too small to make any definitive conclusions so organizational units were regrouped according to the continent in which they were located (see Table 8). An interesting result of this analysis was that the mean was somewhat larger and the variance was considerably smaller for the European subgroup than for the North American subgroup (i.e., U.S.). Combined these results suggest that the impact of ProMES on productivity is stronger and more stable in Europe than in the USA.

These results are even more interesting if they are viewed in light of cross-cultural research on work related values. For example, Hofstede (1983) indicates that workers in cultures with a collectivistic orientation, place more belief in group decisions, and employees in cultures characterized by low power distance, expect a greater say in how they do their jobs. Consequently, one might expect collectivistic cultures low in power distance to be more motivated by an intervention such as ProMES which is typically targeted

towards group performance and allows individuals significant input in determining organizational policy.

According to Hofstede's (1983) research, employees in the European countries included in this analysis are all more collectivistic and expect a greater say in their jobs (i.e., low power distance) relative to workers in the United States. Therefore, these Europeans *should* be more likely to be motivated by ProMES. It is also interesting to note that Australia falls directly between Europe and the United States on these work-related values. In other words, the pattern of results revealed in this analysis is exactly what would be predicted by Hofstede's cross-cultural research on work related values (i.e., effect sizes were highest in countries high in collectivism and low in power distance).

Number of Personnel In Target Unit

As mentioned earlier, there was a -.47 ($p = .006$) correlation between the amount of personnel in the target unit and the associated effect size. The implication of this result is that ProMES is more effective with smaller groups. However, a correlation was also calculated on the relationship between target unit size and the similarity of the development and implementation process used with the original process. This analysis yielded an $r = -.70$ ($p = .000$, $n=38$), which indicates that the larger the target unit the more likely the researchers deviated from the original process. While it is possible that these deviations occurred to accommodate the larger target units, it is more likely that

it may be an artifact resulting from the fact that one researcher, who regularly uses a process which deviates from the original process, supervised nearly all of the projects involving large target groups.

Mean Effects By Type of Worker

Once again the average *d* varies from one subset to another, suggesting that this a potential moderator. Beyond this, the only result that is noteworthy in this analysis is the large standard deviation in the blue collar/labor subcategory. The large standard deviations in the other categories are difficult to interpret because of the small sample sizes. However, the sample size in the blue collar category is large enough to conclude that this are one or more moderators influencing the results of this analysis. The most likely reason is that the categories are defined too broadly to reveal anything by themselves.

Mean Effect By Amount of Formal Education

The average effect size varies across subsets which suggests that this might be a potential moderator of ProMES interventions. A plot of the pattern of results associated with this external variable also reveals the rudimentary beginnings of and inverted "U" (see Figure 10). Although the number of cases in the subgroups precludes any definitive conclusions to be drawn, the pattern of results associated with this external variable is somewhat interesting. It is logical to assume that a certain amount of formal education is required to fully benefit from a ProMES intervention (e.g. to be able to read and interpret the feedback reports) but beyond that it should not be a factor. Yet, if this was true,

one would expect an initial increase in effectiveness as the amount of formal education increases but that this increase would level off, for example, at the 9 to 12 or 13 to 17 years rating. Interestingly, the data here reflects a definite drop off in effectiveness at the high end of the scale.

One explanation for this result might be found in an old proverb common to a number of eastern philosophies. It states that "certainty" is a barrier to true knowledge since if one is certain that he or she knows something, then he or she will not seek to gain further enlightenment on that topic. An application of this proverb to the work setting is that an employee who is certain that he or she knows the best way to fulfill their work responsibilities will be less likely to listen to new approaches designed to improve their effectiveness. A case could be made that the more formal education, the more training one has received regarding how to do their job, and, possibly, the more likely he or she might be "certain" they know the most effective way to carry out his or her job responsibilities. If this is true, it is possible that personnel at the high end of the continuum are less likely to be responsive to new ways of completing their job responsibilities.

Obviously the data do not provide any substantial support for this hypothesis, but it might be interesting to see if this inverted "U" relationship between the amount of formal education and the effect of ProMES on productivity solidifies as more cases are added to the subgroups. It also might be interesting to look for this relationship in other variables such as the time

required to develop the system or level of consensus reached in the design team meetings.

In summary, the pattern of results yielded in the exploratory examination of the role of these external variables, while far from conclusive, did allow for some speculations as to their potential effect. Once the number of cases contained in the database becomes sufficient for more meaningful analysis, the preliminary implications of these analyses can be tested more definitively.

Question 3. Can Variability in the Effect of ProMES Be Explained by Variability in the Informational Value Provided By ProMES Feedback Over Feedback Provided Prior to ProMES?

It was hypothesized that a significant part of the variance observed in the effect of ProMES on productivity could be attributed to the amount of unique information provided by ProMES feedback. More specifically, it was hypothesized that there would be a significant, positive relationship between changes in productivity and the amount of informational value the ProMES feedback provided over the feedback provided to unit personnel prior to ProMES. Direct support for this hypothesis was provided by the .60 correlation between the unique informational value provided by ProMES feedback and the associated effect sizes. This finding suggests that more than a third (36.2%) of the variance observed in the effect of ProMES can be explained by the amount of unique information provided by ProMES feedback. The finding is also consistent with the literature review which indicates that feedback should only

impact performance to the extent that it provides personnel with information beyond what was previously available (Ilgen, et al., 1979).

The potential implications of the observed relationship between the incremental increase in informational value and productivity, however, are noteworthy for several reasons. First, the feedback provided by ProMES has been identified by its proponents as one of the most important elements of the intervention (Pritchard, 1990). This contention is supported by the result that more than a third of the observed variance of the effect of ProMES interventions can potentially be attributed to characteristics of the feedback provided by the system.

Second, the finding demonstrates how essential it is that organizations evaluate their existing measurement and feedback system prior to introducing a new one. The importance of this is graphically represented in Figure 11. Units were grouped according to the amount of unique informational value provided by ProMES feedback into bottom, middle, and top thirds, and then mean effect sizes were estimated for each of the groups. In all cases the ProMES feedback was initially estimated to have more potential informational value than the prior feedback. In spite of this, it is clear from the negative effect sizes associated with the low group in this figure, that the introduction of a new intervention which provides only a minimal amount of unique information may have undesirable consequences.

This negative relationship was an unforeseen result which was difficult at first to understand. Feedback is assumed to affect behavior by changing the direction and/or motivation of the recipient (Lock et al., 1968). At first glance, Kluger and DeNisi's (1996) Feedback Intervention Theory (FIT) would seem to predict that minimal increases in information value would, at the very worst, fail to activate the feedback-standard discrepancy, thus neither increasing nor decreasing motivation. Kluger and DeNisi (1996), however, contend that if the task is well known (e.g., situations were high quality feedback is already provided) feedback can interrupt automatic scripts, cause temporary task interference, and result in decreased performance. In situations where the task is not well known (e.g., situations where the quality of the feedback is not very good), Kluger and DeNisi (1996) argue that feedback can motivate recipients to experiment with new task strategies. Unfortunately, if the incremental information provided by the new feedback is not sufficient to allow personnel to identify strategies that are truly more effective, the individual will experiment with less effective strategies which will result in decreased performance.

Therefore, it is essential that organizations ensure that the introduction of any new feedback intervention significantly improves the quality of information provided to the recipient. However, this can only be accomplished if: (a) the organization assesses their current measurement and feedback system; and (b) they take the time and effort to make sure that the informational

value of the feedback provided by the new feedback system is over and above the one already in place.

In conclusion, the results of this analysis suggests that the answer to the third research question is that the variability in the effect of ProMES can, at least in part, be explained by variability in the informational value provided by ProMES feedback over feedback provided prior to ProMES. However, due to the relatively small number of cases that could be included in this analysis (15), the generalizability of these results to all ProMES studies should be interpreted with care.

Limitations of the Current Study

The major limitation of this study was the scarcity of cases associated with some of the variables of interest. This situation was caused in part by a much lower than expected response rate from some of the primary researchers. This resulted in fewer overall cases in the database, and the need to extract information regarding some of the variables from published manuscripts rather than having them coded by the primary researchers. The lack of information regarding some of the variables was also simply the result of primary researchers being unable to code some of the variables because: (a) information regarding the variables was never collected during the project, and/or (b) the project happened too far back in time for the researcher to accurately provide information regarding the variable. Unfortunately, the subsequent number of cases with available information on many of the

variables precluded any definitive conclusions to be drawn regarding the role of moderating variables. For example, it would have been interesting to partial out the effect of how closely the original development process was followed and then see if the amount of incremental value provide by ProMES feedback continued to moderate the effect of ProMES on productivity. However, when this was attempted in the present study the sample size dwindled to only four units. Thus, it was impossible to determine if the resulting correlation ($r=.93$, $p=.037$) represented a true relationship or was simply a statistical artifact.

The present study also possessed several other limitations. First, direct comparisons of the effect size estimates obtained in this study with others found in the literature still remain problematic because of the psychometric issues surrounding the their use with time series designs. Therefore, the exact magnitude of ProMES relative to other interventions remains unknown. Second, due to the nature of the data, the composite scores used to estimate the informational value of feedback provided prior to ProMES was not based on the same items used to estimate the potential informational value of ProMES feedback. Unfortunately, the effect of this disparity is impossible to ascertain at this time. Finally, response rates could not be calculated in the present study because (a) the method of disseminating the questionnaires made it difficult to determine the number of researchers who actually received a questionnaire, and (b) it was unclear whether the most appropriate estimate should be based

on the number of researchers responding or the number of studies for which they provided information.

Final Conclusions

The hope that PPE's would provide a way to more directly compare effect sizes obtained from time series designs with those obtained from more traditional designs was not realized. As such, comparing the effect sizes estimated in this study with much of the existing literature remains problematic. Consequently, while it remains fairly obvious that the effect of ProMES is quite large, it is still impossible to definitively establish the magnitude of the effect relative to other interventions. One line of future research, therefore, should be to attempt to identify a metric that will allow for direct comparisons.

The study, though, did provide evidence of at least two potential moderators of the success of ProMES projects. First, it appears that the amount of incremental value provided by ProMES feedback does effect the impact of the intervention on productivity. Obviously, this analysis needs to be conducted again once the database contains a more substantial number of cases; however, the strength of the relationship in this study suggests that it is a true moderator and not a statistical artifact. Second, the results provide some early indications that even relatively minor deviations from the original development and implementation process can attenuate the effect of the intervention. One possible avenue of future research would be to identify the

types of deviations that negatively impact the intervention process and the situations in which they occur.

The study also provided some preliminary evidence for the existence of moderators external to the development process. Two of the most interesting variables (at least to this researcher) appear to be the country in which the organizational unit is located and the amount of formal education possessed by unit personnel. An interesting project, once there are enough cases, would be to code units according to Hofstede's dimensional indices rather than by country. Thus use of these continuous, cultural indices, in place of discrete, country variables, could potentially shed more light on the impact of culture in ProMES interventions. It would also be interesting to see if amount of formal education did moderate variables such as the amount of time required for system development, level of consensus, or changes in productivity, and if the shape of this relationship was in fact an inverted "U."

As mentioned in the previous section, the main limitation of this study was the limited number of cases contained in the database with complete information. However, the number of ProMES projects seems to be growing exponentially, and it is quite reasonable to assume that the number of cases contained in the database should also increase significantly in the near future. As the number of cases in the database continues to grow, more sophisticated statistical procedures can be applied, and more definitive conclusions can be drawn on the issues raised in the study.

In conclusion, the primary goals of this study were to create a database to allow comparisons across studies, to provide a more accurate estimate of the average effect of ProMES, and to begin to identify some of the specific factors that contribute to the relative success or failure of ProMES projects. The database was created and, by all indications, will continue to grow as more ProMES projects are conducted. Thus, the first goal of this project was achieved. In addition, although the current study did not provide a solution to the problem associated with comparing time series studies to other designs, the introduction of plateau-*d*'s does potentially allow for more accurate estimates of effects across time series designs. Also, despite some limitations, the results did identify some potential moderators of the success of ProMES. Therefore, while the results were not as definitive as originally hoped, the third objective of this project was for the most part achieved.

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APPENDIX A

EXAMPLES OF SITES WHERE ProMES HAS BEEN USED

MANUFACTURING SETTINGS

- Assembly line manufacturing of consumer products (USA)
- Chemical processing (Netherlands)
- High tech manufacturing of electrical components (Germany)
- Manual assembly of electrical components (Germany)
- Textile manufacturing (USA)
- Steel manufacturing (Netherlands)
- Team based manufacturing of printed circuit boards (USA)
- Manufacture of outdoor equipment (USA)
- Team based manufacturing of cardboard boxes (Netherlands)
- Food (confectionery) manufacturing (Hungary)

SERVICE SETTINGS

- Sales and repair of office machinery (USA)
- Police department (Netherlands)
- Computer repair (Australia)
- Commercial painters (Germany)
- Bank (Netherlands)
- Government social services (Sweden)
- Residential care of mental patients (USA)
- Dock workers (Australia)
- A bar in a restaurant (USA)
- Photocopier maintenance mechanics (Netherlands)

WHITE COLLAR/PROFESSIONAL SETTINGS

- Life insurance agents and their managers (USA)
- Organizational consultants (USA)
- Teaching effectiveness in a university setting (USA)
- Professional school training (Netherlands)
- Counseling services (Switzerland)
- Hospital intensive care ward (Netherlands)
- Top management: Consulting firm (USA)

APPENDIX B

ProMES META-ANALYSIS INSTRUMENT

PROMES META-ANALYSIS INSTRUMENT

June 12, 1995

The purpose of this instrument is to collect data on ProMES projects that will allow us to aggregate the results of our studies using meta-analysis. I will put the database together, agree to keep it current, and distribute it to the contributors. Those who have contributed ProMES studies with productivity data will have access to these data. Those who have not will not have access.

Fill out the instrument as completely as possible, realizing that there will be some missing data on most projects. When you aren't sure how to complete a scale, make notes by that item. That way we can clarify the scales in future versions of the instrument.

The intention is that we fill out the instrument on all past and current projects at this time. Then, once every six months to a year, we update the projects that are still ongoing. This update will be much less involved than the work to do the original questionnaire since the majority of the information will not have changed. If a project has not yet started feedback, it is not necessary to complete the instrument. We will catch that project on the next cycle. Thus, there is no optimal time in the life of a project to complete the instrument. We will continually update the data base.

Fill out one copy of the questionnaire for each ProMES unit.

A lot of work by many of the research teams doing ProMES has gone into making the meta-analysis instrument as complete and as clear as possible. This has resulted in a lengthy questionnaire. Thus, it will take some time to complete the instrument. In addition, it is important that we do the ratings on all the projects we have conducted (including those that were unsuccessful or were not completed) so that we can get as complete a data set as possible.

We have a chance here to create something unique in our field. It is a lot of work, but the payoffs are very large. I appreciate your contributions.

Bob Pritchard

CONTENTS

DEFINITIONS

ProMES Target Unit

To do the meta analysis over time, we need to collect data on each organizational unit where ProMES has been implemented. We call each such ProMES unit a Target Unit. It will be the number of such units that will be the sample size for the meta analysis. Therefore we need to define exactly what a single "Target Unit" is, so we can all use the same definition. For example, if the system is developed by four separate groups in a single organization and there are four design teams and four different feedback reports, this would be four Target Units. We would complete one copy of this questionnaire separately for each of the four Target Units. Some of the ratings will be the same for all four units such as the initial state of the organization factors, but others will be different for each.

In the majority of cases, the number of target units will be very clear. However, there are situations where it is not clear. In general, the defining characteristic for determining a target unit will be whether you would report the effectiveness scores for a given group separately from other groups. If you would report it separately, it would normally be a separate target unit. For example, in one project there were five university departments which did the system. Products and indicators were developed by a joint design team with representatives from all departments and the resulting products and indicators were identical for each department. Then each department developed its own contingencies with its own design team. In addition, some departments developed separate contingency sets for different types of courses. In this example, there were five "target units" since the effectiveness data would be reported to each department separately, and there were five unique feedback reports. For the departments that had more than one contingency set, there was still just one "target unit" for that department since the feedback report was the same for each type of course, they just used different contingencies.

As another example, suppose there are five shifts doing the system on the same exact job in the same location. If each shift develops its own system and has its own unique feedback report, the effectiveness data from each shift would be reported separately and thus there would be five target units. If the five shifts work together to develop the system and the feedback report gives effectiveness for the five shifts combined and in a way that the shifts cannot be separated, there would be only one target unit. If they all use the same measurement system (indicators and contingencies), but each shift has a feedback report on its own work separable from the other shifts, there are five target units. As a final example, if the system was developed for one group and then imposed on three others such that each of the additional three got a feedback report with their own data and had their own feedback meetings, there would be a total of four units.

If these decision rules still leave doubt in a given setting, the final criterion is whether there is reason to expect that the different units can really be considered as different from a meta analytic perspective. That is, if they are different in terms of initial conditions, how the implementation went, or how they responded to the feedback, they should be treated as separate units. If there are no differences possible, they should be combined.

"Local" vs. "Parent" Organization.

In some situations it is important to distinguish between the organization where the ProMES work is being done (the "local" organization) and the broader organization (the "parent" organization). The local

organization is normally the physical setting where the project is being done. It is usually in one building or in a group of buildings that are next to each other. The parent organization, if there is one, owns the local organization, is usually much larger, and located in different cities or countries. In some cases, of course, there is no parent organization. In that case, the answers for the "local" and "parent" questions would be identical.

Target Unit ID Number

Each target unit will be assigned a unique identification number by Pritchard. This will be the major way the data from a given target unit will be kept together. The number will be a 9-digit number with the first three digits being the Parent Organization ID Number, the second three digits the Local Organization ID Number, and the last three digits for that particular target unit. After the first meta analysis questionnaire is completed for a given target unit, Pritchard will assign it its Target Unit ID Number. This number will be used for all future data about the project.

1. CONTACT AND PROJECT INFORMATION

1.1 Contact Information

1. Person(s) filling out this questionnaire:

Name: _____ Title: _____

Name: _____ Title: _____

Name: _____ Title: _____

2. Research/Consulting Group (university/company and city. e.g. Texas A&M, College Station, Texas):

Group: _____ Location: _____

3. Field experience of person(s) filling out this questionnaire:

___ 5. High. All persons filling out the questionnaire have at least two years experience conducting research or doing projects in field settings.

___ 4.

___ 3. Medium. At least one person filling out the questionnaire has at least 2 years of experience conducting research or doing projects in field settings.

___ 2.

___ 1. Low. No one filling out questionnaire has conducted research or done projects in field settings.

4. Date this questionnaire was completed: _____

5. Dates covered by this questionnaire: From _____ To _____

6. Person(s) in charge of the project (typically an external academic or practitioner):

_____

_____

7. Main contact person for future project information. (This should be a senior person who will be available for several years, not a student or someone who is expected to relocate soon.)

Name: _____

University/Company: _____

Department: _____

Address: _____

_____

_____

_____

Phone: _____

Fax: _____

E-mail: _____

1.2 Project Description

1. **Name of the Parent Organization** (e.g. Westinghouse Corporation):

   _____

2. **Name of the Local Organization** (e.g., College Station Assembly Plant) This can be the same as the Parent Organization if there is only one location for the organization:

   _____

3. **Name of the Target Unit** (Use a descriptive name that will uniquely identify this unit now and in the future, e.g. Final Inspection and Testing.)

   _____

4. **Date work with this Parent Organization started.** _____

5. **Date work with this Local Organization started:** _____

6. **Date work with this Target Unit started.** _____

7. **What type of project was this?**
   - _____ 1. A field experiment (An intervention was used. This is the typical ProMES project.)
   - _____ 2. A field survey. Data collected in a field setting but there were no interventions or manipulations.
   - _____ 3. A laboratory study.
   - _____ 4. Other. Explain:

   _____
   _____
   _____

8. **What is the status of the project?**
   - ____ 1. Preliminary discussions are under way, but no commitments have been made to do a project.
   - ____ 2. Commitments have been made to do the project, but it has not started yet.
   - ____ 3. System development has started, but is not completed.
   - ____ 4. Feedback has started and productivity data can/will be collected.
   - ____ 5. The ProMES research/consulting team expects no further contact with the target unit.

9. **What was the primary purpose of using ProMES in this target unit? (Check all that apply)**
   - _____ As a feedback/motivational instrument.
   - _____ As a performance appraisal instrument.
   - _____ To measure productivity to allocate rewards (e.g. pay for performance)
   - _____ As a criterion to study the effects of another intervention, e.g. a new work design.
   - _____ As a management information system.
   - _____ As a way of evaluating the productivity of one part of the organization.
   - _____ As a method for identifying/communicating top management strategy.
   - _____ Other. Explain_____

   _____
   _____

10. **Briefly describe the purpose of using ProMES in this target unit, expanding on your answer to the question above.** For example, to see if ProMES would work in this setting, to combine ProMES with traditional performance appraisal, to evaluate the effects of different levels of participation in the process of doing ProMES, etc.

11. **Briefly describe the design of the project.** This will help us interpret the results. For example: "Three target units (names of the units) developed ProMES in the typical way. Then the system was applied to four other units (names of the units) doing the same work at a different location. The new units only reviewed what the first groups did. They could make changes, but this was discouraged. Two comparison groups were also used (names of the units) throughout the project."

12. **Available papers.** If there are any published or unpublished papers available describing this project, please give the references. If the titles are not in English, please provide a translation of the title.

2. CHARACTERISTICS OF THE ORGANIZATION

2.1 INITIAL STATE OF THE ORGANIZATION AND TARGET UNIT

2.1.1 Description

1. Country where the headquarters of the Parent Organization is located:

_____

2. Function of the Parent Organization. Select the main function of the organization. Manufacturing means that the primary business is making a tangible product, e.g. refrigerators, computers, cardboard boxes. That product is sold or distributed, but most of the effort goes to making the product. A sales organization's primary business is selling something, typically things which they do not make themselves. Examples are insurance companies, department stores, and real estate agencies. A service organization exists to provide a non-tangible service to customers. Examples would be, computer repair companies, and hotels. Educational, research, and military should be clear. Examples of Health Care would be hospitals, rehabilitation centers, nursing homes. There will be some organizations that do more than one thing, so pick the main thing the organization exists for. For example, a university is a service organization, but its primary function is educational.

_____ Manufacturing
_____ Sales
_____ Service
_____ Educational
_____ Research
_____ Military
_____ Health Care

3. Approximate number of people in the overall parent organization at all physical locations:

1) 50 or less _____ 2) 51-100 _____ 3) 101-500 _____
4) 501-1000 _____ 5) 1001-5000 _____ 6) 5001-25,000 _____
7) 25,001-100,000 _____ 8) More than 100,000 _____

4. Briefly describe the Local Organization and what it does.

5. Main function of the local organization.

_____ Manufacturing
_____ Sales
_____ Service
_____ Educational
_____ Research
_____ Military
_____ Health Care

6. What type of organization is the local organization?

_____ 1. Private, for profit
_____ 2. Private, non-profit
_____ 3. Government/Public

7. Country where the local organization is located: _____

8. Approximate number of people in the local organization:

1) 50 or less _____ 2) 51-100 _____ 3) 101-500 _____ 4) 501-1000 ____
5) 1001-5000 _____ 6) Over 5000 _____

9. Briefly describe the Target Unit (the unit doing the ProMES system) and what it does.

10. Function of the target unit.

_____ Manufacturing
_____ Sales
_____ Service
_____ Educational
_____ Research
_____ Military
_____ Health Care

11. Approximate number of people in the target unit: _____

12. Which of the following best describes the majority of workers in the target unit:

___ Managerial/professional (manager, accountant, lawyer, etc.)
___ Blue-collar/labor (carpenter, welder, non-skilled laborer, etc.)
___ Technician (photocopier repair, emergency room nurse, etc.)
___ Sales (life insurance sales, car salesperson, etc.)
___ Clerical/office
___ Academic/teaching
___ Other. Specify: _____

13. Amount of formal education of the typical person in the target unit. (Includes education at primary school, secondary school, vocational school, high school, university, master's program, doctoral program, etc. Does not include formal training done by their employers.)

___ 5. More than 20
___ 4. 18 - 20
___ 3. 13 - 17 years
___ 2. 9 - 12 years
___ 1. 9 years or less

2.1.2. Structural Characteristics

Centralization: the degree to which decision-making and authority are centralized or delegated. A completely centralized organization is one where all decision-making authority rests in the hands of a single top manager. A completely decentralized organization is one where every employee has a say in making decisions.

1. To what extent was the structure of the target unit centralized?

___ 5. Highly centralized. Virtually all decision-making authority rested with the supervisor of the target group.
___ 4.
___ 3. Neither. Some important decisions were made by the supervisor and some important decisions were made by target unit personnel.
___ 2.
___ 1. Highly decentralized. All target unit personnel had a say in making virtually all important decisions.

2. To what extent was the structure of the local organization centralized?

___ 5. Highly centralized. Virtually all decision-making authority rested with upper management.
___ 4.
___ 3. Neither. Some important decisions were made by the upper management and some important decisions were made by personnel at lower levels of the local organization.
___ 2.
___ 1. Highly decentralized. All personnel had a say in making virtually all important decisions.

Formalization: the degree to which rules, procedures, and behavioral directives are laid down in writing.

3. To what extent was the structure of the target unit formalized?
   ___ 5. Highly formalized. All rules, policies, and procedures governing behavior were set forth in writing.
   ___ 4.
   ___ 3. Moderately formalized. Some rules, policies, and procedures governing behavior were set forth in writing.
   ___ 2.
   ___ 1. Not formalized. No rules, policies, and procedures governing behavior were set forth in writing.

4. To what extent was the structure of the local organization formalized?
   ___ 5. Highly formalized. All rules, policies, and procedures governing behavior were set forth in writing.
   ___ 4.
   ___ 3. Moderately formalized. Some rules, policies, and procedures governing behavior were set forth in writing.
   ___ 2.
   ___ 1. Not formalized. No rules, policies, and procedures governing behavior were set forth in writing.

Workflow interdependence: the degree to which different divisions in the organization are dependent on one another for the accomplishment of tasks.

5. To what extent was the target unit dependent on other units in the organization?
   ___ 5. Completely dependent. The target unit could not complete any of its tasks without inputs from other units.
   ___ 4.
   ___ 3. Neither. The target unit could complete some of its tasks without inputs from other units.
   ___ 2.
   ___ 1. Completely independent. The target unit did not require inputs from any other units to complete its tasks.

Specialization: the degree to which members of the unit have tasks and duties that cannot be done by other members of the unit without additional education or training.

6. To what extent was the target unit specialized?
   ___ 5. Completely specialized. No one in the target unit could do the job of another.
   ___ 4.
   ___ 3. Neither. Some of the people in the target unit could do the jobs of others.
   ___ 2.
   ___ 1. Completely unspecialized. All jobs in the target unit could be done by each person in the unit.

Centrality: the degree to which a given unit is central or essential to the functioning of the broader local organization. For example, in a manufacturing organization a unit making things the organization sells would be very central, a unit training new employees to operate the machinery would be moderately central, and a unit keeping track of employee benefits would not be central.

7. How central was the work of this target unit to the functioning of the organization?
   - ___ 5. Highly central to the main mission of the organization
   - ___ 4.
   - ___ 3. Moderately central to the main mission of the organization
   - ___ 2.
   - ___ 1. Not central to the main mission of the organization

Complexity - Technological. Includes technological and task complexity.

8. Given this definition, how technologically complex was this target unit?
   - ___ 5. Highly complex. The target unit was on the complex end of most of the complexity factors listed above.
   - ___ 4.
   - ___ 3. Moderately complex. The target unit was in the middle of most of the complexity factors listed above.
   - ___ 2.
   - ___ 1. Not complex. The target unit was on the simple end of most of the complexity factors listed above.

Complexity - Structural. Includes degree of interdependence with other units, number of shifts, and physical separation of target unit personnel.

9. Given this definition, how structurally complex was this target unit?
   - ___ 5. Highly complex. The target unit was on the complex end of most of the complexity factors listed above.
   - ___ 4.
   - ___ 3. Moderately complex. The target unit was in the middle of most of the complexity factors listed above.
   - ___ 2.
   - ___ 1. Not complex. The target unit was on the simple end of most of the complexity factors listed above.

Complexity - Demands. Includes complex, changing and sometimes conflicting sets of demands from different sources. Presence of complex internal and external constituencies (e.g. unions and monitoring groups).

10. Given this definition, how complex were the demands on this target unit?
    - ___ 5. Highly complex. The target unit was on the complex end of most of the complexity factors listed above.
    - ___ 4.
    - ___ 3. Moderately complex. The target unit was in the middle of most of the complexity factors listed above.
    - ___ 2.
    - ___ 1. Not complex. The target unit was on the simple end of most of the complexity factors listed above.

Stability

11. Stability of the local organization's external environment throughout the course of the project. External environment would include external customer demands, competitors, regulations, the nature of the market, etc.

_____ 5. Highly stable. The external environment did not change in meaningful ways during the course of the project.
_____ 4.
_____ 3. Moderately stable. Some important features of the external environment changed, but many were quite stable during the course of the project.
_____ 2.
_____ 1. Highly unstable. Most important features of the external environment changed during the course of the project.

12. Degree of stability of the technology in the target unit throughout the course of the project.

___ 5. The technology did not change in any meaningful way during the project.
___ 4.
___ 3. There were minor changes in technology during the project.
___ 2.
___ 1. There were major changes in technology during the project

13. What was the average percentage of the target unit personnel annual turnover during the project? _____ %

14. The stability of the local organization's management.

What percentage of turnover in management positions in the local organization occurred from the start of the project (i.e., since approval was received to do the project with this unit) until the first feedback report was given? ____%

What percentage of turnover in management positions occurred at the local organization from the start of the project until six months after the start of feedback?
____ % Unit has not had six months of feedback _____.

From the start of the project to six months after the start of feedback, what percent of managers important to initially approving the ProMES project have left the organization or gone to new positions in the organization in areas unrelated to where the ProMES work is being done?
____ % Managers Unit has not had six months of feedback _____.

2.1.3 Job Characteristic Variables (JDS) for the Target Unit

Describe the target unit's work with these scales. (The following items are adapted from the items in section 1 of Hackman & Oldham's 1975 Job Diagnostic Survey, Development of the Job Diagnostic Survey, Journal of Applied Psychology, 60, 159-170, quoted from Cook, J. D., Hepworth, S. J., Wall, T. D., & Warr, P.B. 1981. The experience of work: A compendium and review of 249 measures and their use. London: Academic Press.).

Skill variety: the degree to which the job requires a variety of different activities in carrying out the work, which involve the use of a number of different skills and talents of the employee.

1. How much variety did the job contain? That is, to what extent did the job require group members to do many different things at work, using a variety of skills and talents?

___5. Very much, the job required group members to do many different things, using a number of different skills and talents.
___ 4.
___ 3. Moderate variety.
___ 2.
___ 1. Very little, the job required group members to do the same routine things over and over again.

Task identity: the degree to which the job requires completion of a "whole" and identifiable piece of work, i.e., doing a job from beginning to end with a visible outcome.

2. To what extent did the job involve individuals within the group doing a "whole" and identifiable piece of work? That is, was the work performed by individuals within the group a complete piece of work that had an obvious beginning and end? Or did it only comprise a small part of the overall piece of work, which was finished by other members of the group or automatic machines?

___ 5. The individual's job involved doing a whole piece of work from start to finish, the results of their activities were easily seen in the final product or service.
___ 4.
___3. The individual's job was a moderate size "chunk" of the overall piece of work performed by the group, their contribution could be seen in the final outcome.
___ 2.
___ 1. The individual's job was only a tiny part of the overall piece of work performed by the group, the results of their labor could not be seen in the final product or service.

3. To what extent did the job involve the group as a unit doing a "whole" and identifiable piece of work? That is, was the work performed by the group as a unit a complete piece of work that had an obvious beginning and end? Or was it only a part of the overall piece of work, which was finished by individuals or machines outside of the group?

___ 5. The job of the group involved doing the whole piece of work from start to finish.
___ 4.
___3. The job of the group was a moderate size part of the overall piece of work.
___ 2
___ 1. The job of the group was only a tiny part of the overall piece of work performed.

Task significance: the degree to which the job of the group has a substantial impact on the lives or work of other people, whether in the immediate organization or in the external environment.

4. In general, how significant or important was the job? That is were the results of the group's work likely to significantly affect the lives or well-being of other people?

___ 5. Highly significant, the outcomes of the group's work could affect other people in very important ways.
___ 4.
___ 3. Moderately significant.
___ 2.
___ 1. Not very significant, the outcomes of the group's work were not likely to have important effects on other people.

Autonomy: the degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out.

5. How much individual autonomy was there in the job? That is, to what extent did the job allow individual group members to decide on their own how to do the job?

___ 5. Very much, the job allowed individual group members almost complete responsibility for deciding how and when the work was done.
___ 4.
___ 3. Moderate autonomy, many things were standardized and not under the individual group member's control, but individual group members could make some decisions about their work.
___ 2.
___ 1. Very little, the job allowed individual group members almost no personal "say" about how and when the work was done.

6. How much group autonomy was there in the job? That is, to what extent did the job allow the group as a unit to decide on their own how to do the job?

___ 5. Very much, the job allowed the group almost complete responsibility for deciding how and when the work was done.
___ 4.
___ 3. Moderate autonomy, many things were standardized and not under the group's control, but the group could make some decisions about their work.
___ 2.
___ 1. Very little, the job allowed the group almost no personal "say" about how and when the work was done.

Feedback from the job itself: the degree to which carrying out the work activities required by the job results in the employee obtaining direct and clear information about the effectiveness of his or her performance.

7. To what extent did the job itself provide group members with information about their performance? That is, did the actual work itself provide clues about how well the group was doing - aside from any feedback provided by supervisors or co-workers?

___ 5. Very much, the job was set up so that group members received almost constant feedback.
___ 4.
___ 3. Sometimes doing the job provided feedback to the group, sometimes it did not.
___ 2.
___ 1. Very little, the job itself provided almost no feedback, so the group could work forever without finding out how well they were doing.

Feedback from agents: the degree to which the employee receives clear information about his or her performance from supervisors or co-workers.

8. To what extent did managers or co-workers let group members know how well they were doing on the job?

___ 5. Very much, managers or co-workers provided group members with almost constant feedback about how well they were doing.
___ 4.
___ 3. Moderately, sometimes people gave feedback, other times they did not.
___ 2.
___ 1. Very little, people almost never let group members know how well they were doing.

Dealing with others: the degree to which the job requires the employee to work closely with other people in carrying out the work activities (including dealings with other organization members and with external organizational "clients").

9. To what extent did the job require individuals within the group to work with each other.

___ 5. Very much, dealing with other group members was an absolutely essential and crucial part of doing the job.
___ 4.
___ 3. Moderately, some dealing with other group members was necessary.
___ 2.
___ 1. Very little, dealing with other group members was not at all necessary in doing the job.

10. To what extent did the job require individuals within the group to work with individuals outside of the group (either within or outside the organization).

___ 5. Very much, dealing with individuals outside of the group was an absolutely essential and crucial part of doing the job.
___ 4.
___ 3. Moderately, some dealing with individuals outside of the group was necessary.
___ 2.
___ 1. Very little, dealing with individuals outside of the group was not at all necessary in doing the job.

2.1.4. Psychological Characteristics

Degree of trust between target unit members and management.

1. Degree of trust the target unit has in management
   - ___ 5. Very much. Members of the target unit felt that management would never take advantage of them.
   - ___ 4.
   - ___ 3. Moderate. Members of the target unit trusted management would be supportive in most situations but felt they would take advantage of them occasionally.
   - ___ 2.
   - ___ 1. Very little. Target unit members felt that management would take advantage of them at every opportunity.

2. Degree of trust management had in the members of the target unit.
   - ___ 5. Very much. Management felt that the target unit would never take advantage of them.
   - ___ 4.
   - ___ 3. Moderate. Management felt that the target unit would be supportive in most situations but felt that they would take advantage of them occasionally.
   - ___ 2.
   - ___ 1. Very little. Management felt that the target unit would take advantage of them at every opportunity.

3. **Degree of agreement in organizational values between target unit personnel and management.** This item gets at something different from trust. It is the degree to which target unit personnel and management feel the same things are important and worth working towards in the organization.
   - ___ 5. High agreement. Clear agreement and a willingness to work together to achieve those values.
   - ___ 4.
   - ___ 3. Moderate agreement. Some disagreement in what was important, but a willingness existed to work together.
   - ___ 2.
   - ___ 1. Low agreement. Significant disagreement in values and a lack of willingness to work together.

2.2 INITIAL CONDITIONS AND ATTITUDES TOWARDS PRODUCTIVITY AND PROMES

2.2.1 Initial Conditions

1. **How much experience did the local organization have with productivity enhancement programs?**
   - ___ 5. The local organization had done many formal productivity enhancement programs in recent years
   - ___ 4.
   - ___ 3. The local organization had done some formal productivity enhancement programs in recent years
   - ___ 2.
   - ___ 1. The local organization had done no formal productivity enhancement programs in recent years

2. **How much experience did the target unit have with productivity enhancement programs?**
   - ___ 5. The target unit had done many formal productivity enhancement programs in recent years
   - ___ 4.
   - ___ 3. The target unit had done some formal productivity enhancement programs in recent years
   - ___ 2.
   - ___ 1. The target unit had done no formal productivity enhancement programs in recent years

Level of productivity prior to the start of the project:

3. Was management aware of the target unit's level of productivity prior to the start of the project?
   ___ Yes ___ No.

4. If yes, how was the target unit's productivity perceived by management before the start of the project?
   ___ 5. Well above organizational expectations
   ___ 4. Somewhat above organizational expectations
   ___ 3. Meeting organizational expectations
   ___ 2. Somewhat below organizational expectations
   ___ 1. Clearly below organizational expectations

5. **Frequency of <u>quantitative</u> performance/productivity feedback given to the target unit before ProMES.**
   ___ 9. More than once a day
   ___ 8. Daily
   ___ 7. Weekly
   ___ 6. Monthly
   ___ 5. Every 2-5 months
   ___ 4. Every 6 - 11 months
   ___ 3. Yearly
   ___ 2. Less than once a year
   ___ 1. Never

6. **<u>Quality</u> of performance/productivity feedback given to the target unit prior to ProMES.** Many things go into the quality of the feedback a unit receives. These factors include accuracy, controllability, congruence with overall organizational functioning, timeliness, understandability, and comprehensiveness. Taking all these factors into consideration how good was the formal and informal feedback the target unit personnel received prior to ProMES?
   ___ 5. Excellent
   ___ 4. More than adequate
   ___ 3. Adequate
   ___ 2. Less than adequate
   ___ 1. Poor

7. **To what extent were there serious problems in the target unit at the start of the project?** Examples would include serious conflicts within the group or with the group and management, major organization problems, serious management problems, etc.
   ___ 5. There were many serious problems
   ___ 4.
   ___ 3. There were some moderately serious problems
   ___ 2.
   ___ 1. There were no meaningful problems

8. **Activities prior to starting the formal ProMES process.** In some cases it becomes clear that work must be done with the group before the ProMES process starts, such as dealing with trust or conflict between target unit personnel and management. How much work of this sort was done with this unit?

___ 5. A substantial amount was done.
___ 4.
___ 3. A moderate amount was done.
___ 2.
___ 1. None was done.

If you, selected 3 or higher, describe what the problems were and what was done.

_____
_____
_____
_____
_____

9. **At the start of the project, how many other units in the local organization had done ProMES projects?** _____ Units

2. 2. 2. Initial Attitudes and Expectations

1. **What advantages of ProMES were important to the organization in deciding to start the project? (Check all that apply.)**

_____ Improving productivity
_____ A mechanism for employee participation
_____ Improving quality
_____ Reducing stress
_____ Helping groups manage themselves
_____ As a criterion measure to do something else, e.g. pay for performance
_____ As a way of monitoring organizational units more accurately
_____ As a way of clarifying or communicating organizational policy
_____ Improving the image of the organization as being modern and progressive
_____ Other. Describe:

_____

Rate each of the attitudes below using the scale below:

1. Strong disagreement 2. Moderate disagreement 3. Neutral 4. Moderate agreement 5. Strong agreement

2. How did <u>management</u> feel about productivity?

____ Productivity improvement is important.
____ Productivity improvement is not easy.
____ Productivity improvement is a long-term effort, not something that can be done quickly.
____ Organizational performance is heavily dependent on personnel behavior.
____ Quantitative measurement is important.
____ For a program to be good, it must be invented here.

3. How did the <u>personnel in the target unit</u> feel about productivity?

____ Productivity improvement is important.
____ Productivity improvement is not easy.
____ Productivity improvement is a long-term effort, not something that can be done quickly.
____ Organizational performance is heavily dependent on personnel behavior.
____ Quantitative measurement is important.
____ For a program to be good, it must be invented here.

4. How did the <u>personnel in the union</u> feel about productivity?

____ Productivity improvement is important.
____ Productivity improvement is not easy.
____ Productivity improvement is a long-term effort, not something that can be done quickly.
____ Organizational performance is heavily dependent on personnel behavior.
____ Quantitative measurement is important.
____ For a program to be good, it must be invented here.
____ No union was involved.

5. Constituencies value of productivity improvement. There are a number of influential constituencies in any organization such as the target unit personnel, supervision, management, works councils, unions, professional organizations, etc. To what extent did the influential constituencies believe productivity improvement was valuable?

_____ 5. All constituencies felt productivity improvement was highly valuable
_____ 4. All constituencies felt productivity improvement was somewhat valuable
_____ 3. One constituency did not feel productivity improvement was valuable
_____ 2. More than one constituency did not feel productivity improvement was valuable
_____ 1. More than two constituencies did not feel productivity improvement was valuable

Which constituency or constituencies did <u>not</u> feel productivity improvement was valuable? Explain.

_____
_____
_____
_____

Expectations of project success by management (indicate the average expectations of those managers who were involved in the decision to do the project):

6. At the start of the project:

___ 5. High. They expected substantial improvements from the project.
___ 4.
___ 3. Uncertain. They did not know what to expect.
___ 2.
___ 1. Low. They had serious doubts that anything of value would come from the project.

7. At the time feedback started:

___ 5. High. They expected substantial improvements from the project.
___ 4.
___ 3. Uncertain. They did not know what to expect.
___ 2.
___ 1. Low. They had serious doubts that anything of value would come from the project.

Expectations of project success by the immediate supervisors of the target unit (indicate the average expectations of the supervisors):

8. At the start of the project:

___ 5. High. They expected substantial improvements from the project.
___ 4.
___ 3. Uncertain. They did not know what to expect.
___ 2.
___ 1. Low. They had serious doubts that anything of value would come from the project.

9. At the time feedback started:

___ 5. High. They expected substantial improvements from the project.
___ 4.
___ 3. Uncertain. They did not know what to expect.
___ 2.
___ 1. Low. They had serious doubts that anything of value would come from the project.

Expectations of project success by personnel in the target unit (indicate the average expectations of the people in the unit):

10. At the start of the project:

___ 5. High. They expected substantial improvements from the project.
___ 4.
___ 3. Uncertain. They did not know what to expect.
___ 2.
___ 1. Low. They had serious doubts that anything of value would come from the project.

11. At the time feedback started:

___ 5. High. They expected substantial improvements from the project.
___ 4.
___ 3. Uncertain. They did not know what to expect.
___ 2.
___ 1. Low. They had serious doubts that anything of value would come from the project.

Expectations of project success by personnel in the union/works council (indicate the average expectations of the union/works council personnel):

12. At the start of the project:

___ 5. High. They expected substantial improvements from the project.
___ 4.
___ 3. Uncertain. They did not know what to expect.
___ 2.
___ 1. Low. They had serious doubts that anything of value would come from the project.

13. At the time feedback started:

___ 5. High. They expected substantial improvements from the project.
___ 4.
___ 3. Uncertain. They did not know what to expect.
___ 2.
___ 1. Low. They had serious doubts that anything of value would come from the project.

2. 2. 3. Management, Supervisor and Union Support

1. **Highest organization level where the ProMES project was supported:** (Check the highest level.)

___ 5. Top management: parent. The highest levels of the parent organization's management directly supported the project. (If there is no parent organization and the top level of the local organization supported the project, use this rating.)
___ 4. Top management: local. The highest levels of the local organization's management directly supported the project, but not the top level of the parent organization.
___ 3. Middle management: local. Middle management of the local organization directly supported the project, but not top management.
___ 2. Lower level management: local. Lower level management of the local organization directly supported the project, but not middle or top management.
___ 1. Supervisors only. The project was supported at the supervisory level but not by any levels of management.

2. **At the start of the project (i.e., when the design team started meeting), to what extent did management support the project?** Management support is composed of verbal support to the project directors and the target unit, support with organizational resources such as paid employee time and space to work, and publicly stated support of the project to others in the organization.

___ 5. High. Management was willing to invest as many resources and support as needed to insure the success of the project, and helped the project whenever help was needed.
___ 4.
___ 3. Moderate. Management was willing to invest some resources and support in the project, and was helpful in some instances and not in others.
___ 2.
___ 1. Low. Management was unwilling to invest any resources and support in the project, and was uncooperative with people involved with the project.

3. **Once the project was under way, to what extent did management continue to support the project?**

___ 5. High. Management continued to be willing to invest as many resources and support as needed to insure the success of the project, and helped the project whenever help was needed.

___ 4.

___ 3. Moderate. Management continued to be willing to invest some resources and support in the project, and was helpful in some instances and not in others.

___ 2.

___ 1. Low. Management became unwilling to invest any significant resources and support in the project, and was not helpful when needed.

4. **At the start of the project (i.e., when the design team started meeting), to what extent did supervisors of the units support the project?** Supervisory support is composed of verbal support to the project directors and design team, support with organizational resources such as time and space to do ProMES work, and publicly stated support of the project to others in the organization.

___ 5. High. Supervisors were willing to invest as many resources and support as needed to insure the success of the project, and helped the project whenever help was needed.

___ 4.

___ 3. Moderate. Supervisors were willing to invest some resources and support in the project, and were helpful in some instances and not in others.

___ 2.

___ 1. Low. Supervisors were unwilling to invest any resources and support in the project, and were uncooperative with people involved with the project.

5. **Once the project was under way, to what extent did supervisors support the project?**

___ 5. High. Supervisors were willing to invest as many resources and support as needed to insure the success of the project, and helped the project whenever help was needed.

___ 4.

___ 3. Moderate. Supervisors were willing to invest some resources and support in the project, and were helpful in some instances and not in others.

___ 2.

___ 1. Low. Supervisors were unwilling to invest any resources and support in the project, and were uncooperative with people involved with the project.

6. **At the start of the project (i.e. when the design team started meeting), to what extent did the union/works council support the project? (A works council is primarily a European institution which is composed of full-time employees of the organization who represent the union at the work site.)** Union/works council support is verbal support to the project directors, cooperation with project personnel, publicly stated support to other union and works council members, and publicly stated support of the project to the design team and others in the organization.

___ 5. High. Unions/works councils were willing to support as needed to insure the success of the project, and helped the project whenever help was needed.

___ 4.

___ 3. Moderate. Unions/works councils were helpful in some instances and not in others.

___ 2.

___ 1. Low. Unions/works councils were unwilling to support in the project, and were uncooperative with people involved with the project.

___ 0. Not applicable. There were no unions/works councils in this setting.

7. **Once the project was under way, to what extent did the union/works council support the ProMES project?**

___ 5. High. Unions/works councils were willing to support as needed to insure the success of the project, and helped the project whenever help was needed.

___ 4.

___ 3. Moderate. Unions/works councils were helpful in some instances and not in others.

___ 2.

___ 1. Low. Unions/works councils were unwilling to support in the project, and were uncooperative with people involved with the project.

___ 0. Not applicable. There were no unions/works councils in this setting.

3. DESCRIPTION OF THE DEVELOPED SYSTEM

3.1 CHARACTERISTICS OF THE PROCESS

3.1.1 Composition of the Design Team

1. **How many of the following were present at the typical meeting of the design team? Put the number of each in the space provided.**
   - _____ Unit personnel. People in the target unit who were not supervisors.
   - _____ First-line supervisors. People who were the direct supervisors of the personnel in the target unit.
   - _____ Higher level supervisors. People who the first-line supervisors reported to.
   - _____ Facilitators. Person(s) with speaking role(s) chiefly responsible for moderating the meetings and coordinating the development process.
   - _____ Co-facilitators. Less responsibility than other facilitators, but still had a speaking role.
   - _____ Observers. People from outside the work unit with no speaking role.
   - _____ Others: Describe: _____

2. **How many organizational levels were represented on the design team?** _____

3. **What percent of target unit personnel were part of the design team?** _____

4. **Stability of the design team.**
   What percentage of the following design team personnel were the same people throughout the entire ProMES development process?
   - ____ Facilitators and co-facilitators
   - ____ Supervisors
   - ____ Target unit personnel who were not supervisors

5. **Amount of diversity in the design team. Diversity here means differences in gender, cultural background, race, nationality, etc. How much overall diversity was present in the design team?**
   - ___ 5. High. Considerable variability in most of the above diversity factors.
   - ___ 4.
   - ___ 3. Moderate. Moderate variability in some of the above diversity factors.
   - ___ 2.
   - ___ 1. Low. Very little variability in any of the above diversity factors.

6. **Amount of diversity in the complete target unit.**
   - ___ 5. High. Considerable variability in most of the above diversity factors.
   - ___ 4.
   - ___ 3. Moderate. Moderate variability in some of the above diversity factors.
   - ___ 2.
   - ___ 1. Low. Very little variability in any of the above diversity factors.

7. **How experienced was the ProMES facilitator?** (Indicate the experience level of the most experienced facilitator.)
   - ___ 5. Had previous experience as a facilitator.
   - ___ 4. Had previous experience as a co-facilitator. (A co-facilitator is an assistant to the facilitator, with a speaking role, but does not lead the group).
   - ___ 3. Had observed ProMES being developed in a real (non-training) setting.
   - ___ 2. Had received some formal training in ProMES by an experienced facilitator (e.g. a workshop) but no actual experience.
   - ___ 1. Knew about ProMES from reading only.

8. **Amount of supervision of the ProMES facilitator.**
   - ___ 5. The facilitator was supervised by an experienced ProMES facilitator who was present in the design team meetings.
   - ___ 4. The facilitator was directly supervised by an experienced ProMES facilitator who was regularly available, but was not in the design team meetings.
   - ___ 3. The facilitator was supervised frequently by a person experienced in organizational interventions, but the supervisor had no direct experience with ProMES.
   - ___ 2. The facilitator was supervised infrequently by a person experienced in organizational interventions, but the supervisor had no direct experience with ProMES.
   - ___ 1. The facilitator had no formal supervision.

9. **Structure of the design team. Indicate the percentage of the work done to design the system with each type of group structure.**
   - ____ % Face-to-face; typical group setting.
   - ____ % Nominal; information was passed from person-to-person without face-to-face contact (e.g., Delphi technique).
   - ____ % One-on-one; facilitator meets with each person in the design team separately.
   - ____ % Other. describe: _____

3.1.2 Characteristics of the Design Team Setting

1. **During what time was the system developed?**
   - ___ 3. During normal working hours.
   - ___ 2. Outside of normal working hours, with compensation.
   - ___ 1. Outside of normal working hours, without compensation.

2. **Was the setting in which the design teams met to develop the system conducive to doing work?** (For example, a setting might be too noisy, too hot or cold, or have too many distractions.)
   - ___ 5. Setting was conducive to doing work in all aspects.
   - ___ 4.
   - ___ 3. Setting had some characteristics that made working somewhat more difficult.
   - ___ 2.
   - ___ 1. Setting possessed elements which made it very difficult to work.

3. **On the average, how frequently were system development meetings conducted?**
   - ___ 8. More than once a week
   - ___ 7. Once a week
   - ___ 6. Once every two weeks
   - ___ 5. Once every 3 - 4 weeks
   - ___ 4. Once every 5 - 7 weeks
   - ___ 3. Once every 2 - 3 months
   - ___ 2. Once every 4 - 6 months
   - ___ 1. Less than once every 6 months

4. **What was the average length of design team meetings? _____ Hours**

5. **What was the total number of hours of design team meetings from the first meeting to when the first feedback report was distributed? _____ Hours**

6. **What was the total number of meetings from the first design team meeting to when the first feedback report was distributed? _____ Meetings**

7. **How many person-hours of work were done by the facilitators and their staff outside the meetings of the design team during the process of developing the system? Do not include time to maintain the system once operational. _____ Person hours**

8. **How many months were there between the start of the project (the first design team meeting) and when system design was completed (when the feedback report was designed)?**
   _____ Months

9. **How many months were there between the first design team meeting and distributing the first feedback report? _____ Months**

3.1.3 Dynamics of the Design Team Meetings During Product, Indicator, and Contingency Development

1. **Amount of consensus reached on the major issues:**
   - ___ 5. Complete agreement was reached on all major issues
   - ___ 4. Clear consensus was reached on all major issues
   - ___ 3. Clear consensus was reached on most major issues, but not all
   - ___ 2. Clear consensus was reached on some major issues, but not most of them
   - ___ 1. Clear consensus was reached on only a few major issues

2. **What percent of the target unit personnel in the design team were actively involved in design team meetings?** (Actively involved means they were present, attended carefully to what was happening, clearly understood what was going on, and spoke regularly.) _____%

3. **Tolerance for minority opinions.** To what extent were positions different from the majority position tolerated by the design team?
   - ___ 5. Different positions were highly valued.
   - ___ 4. Different positions were somewhat valued.
   - ___ 3. Different positions were tolerated.
   - ___ 2. Different positions were somewhat discouraged.
   - ___ 1. Different positions were not tolerated.

4. **The amount of influence the supervisor(s) had on the content of the completed system:**
   - ___ 5. System development was dominated by the supervisor(s).
   - ___ 4. The supervisor(s) had more influence than the average person in the group.
   - ___ 3. The supervisor(s) had about the same influence as the average person in the group.
   - ___ 2. The supervisor(s) had less influence than the average person in the group.
   - ___ 1. The supervisor(s) had no influence on the content of the completed system.

3.1.4 Training

1. **What type of training did members of the target unit receive to help them read and interpret the data in the feedback report?**
   - ___ 5. The system was explained in great detail to the target unit and they were given examples of feedback data and how they would be used. (Use this response if the entire unit was on the design team.)
   - ___ 4.
   - ___ 3. The system and how it worked was explained to the entire unit in a meeting or other formal way.
   - ___ 2.
   - ___ 1. No formal training was done other than the design team informally explaining the system to their peers.

2. **What type of training did supervisors receive to help them read and interpret the data in the feedback report?**
   - ___ 5. The system was explained in great detail to the supervisors and they were given examples of feedback data and how they would be used. (Use this response if the entire unit was on the design team.)
   - ___ 4.
   - ___ 3. The system and how it worked was explained to the supervisors in a meeting or other formal way.
   - ___ 2.
   - ___ 1. No formal training was done other than design team informally explaining the system to their supervisors.

3. **What type of training did management receive to help them read and interpret the data in the feedback report?**
   - ___ 5. The system was explained in great detail to management and they were given examples of feedback data and how they would be used.
   - ___ 4.
   - ___ 3. The system and how it worked was explained to management in a meeting or other formal way.
   - ___ 2.
   - ___ 1. No formal training was done other than design team members informally explaining the system to management.

4. **What type of training did person(s) responsible for conducting feedback meetings (normally supervisor) receive prior to holding feedback meetings to help them conduct meetings? Check all that apply.**
   - ____ Person(s) responsible was given role playing or other experiential training on how to conduct feedback meetings
   - ____ Person(s) responsible was given some suggestions on how to deal with feedback meetings
   - ____ The system and how it worked was explained to the supervisor(s) in a meeting or other formal way
   - ____ No formal training

5. **How many feedback meetings did facilitators attend, and when needed, give suggestions to the person responsible for conducting the feedback meetings? _____ Meetings**

3.1.5 Other Issues Related to the Development Process

1. **During the development of the system, how were the members of the target unit who were not part of the design team informed about the design team's activities and progress?**
   - _____ 5. A formal process was used and done on a regular basis
   - _____ 4.
   - _____ 3. A formal process was used (such as memos, announcements, rotating personnel through the design team, etc.) but this was not done on a regular basis
   - _____ 2.
   - _____ 1. No formal process, but it is assumed the rest of the target unit was informed informally by design team members.
   - _____ The entire unit was in the design team, so it was not an issue.

2. **What percentage of the objectives (products) were *substantially* changed to obtain formal management approval? (A slight wording change, combining two products into one, or dividing a product into two products are not substantial changes. Adding a new product, dropping a product, or significantly altering the meaning of a product is a substantial change.) _____%**

3. **What percentage of the indicators were *substantially* changed to obtain formal approval? (Use the same idea for "substantial" as in changes of objectives above.) _____%**

4. **What percentage of the contingencies were *substantially* changed to obtain formal approval? (Substantial here means a change that alters the expected level or other effectiveness scores so that the contingency is really different than it was. A change of 3-5 effectiveness score points would not normally be considered a substantial change.) _____%**

5. **Did the contingency development process utilize the complete approach as described in the 1990 ProMES book, or was an abbreviated method used?** An example of an abbreviated method would be to only identify minimum, zero point, and maximum effectiveness values and ignore any non-linearity between these points.
   - _____ Full process was used.
   - _____ Abbreviated process was used. Describe: _____

6. **Overall, how closely did the development and implementation of the system in this setting match the process outlined in the 1990 ProMES book?**

_____ 5. Very closely. That process was followed as closely as possible.
_____ 4. Closely. That process was followed with only minor changes.
_____ 3. Moderately. A few meaningful changes were made.
_____ 2. Not closely. Several substantial changes were made.
_____ 1. Very differently. Many substantial changes were made.

Describe the major changes:

_____
_____
_____
_____
_____
_____

3.2 CHARACTERISTICS OF THE DEVELOPED SYSTEM

3.2.1 Descriptive Characteristics

1. **What unit of analysis was the system designed to measure? (Check all that apply.)**

_____ 4. Entire organization
_____ 3. Collection of groups
_____ 2. Group
_____ 1. Individual

2. **How many objectives (products) were in the completed system?** _____

3. **How many indicators were in the completed system?** _____

4. **How many of the indicators had been used in the past in the target unit prior to ProMES system development?** _____

5. **What percentage of important indicators were actually included in the final system (e.g., some indicators may have been dropped because they were deemed too difficult or costly to measure)?** _____%

6. **How many contingencies were in the completed system?** _____

7. **In most studies the expected level was equal to zero, but in some studies another value was used. What was the effectiveness score for the expected level in this study?** _____

8. **In your opinion, how high were the expected levels set?**

___ 5. Quite high. Expected levels were set above what would just meet expectations.
___ 4.
___ 3. About right.
___ 2.
___ 1. Quite low. Expected levels seemed below what would just meet expectations.

9. **What was the maximum possible overall effectiveness score?** _____

10. What was the minimum possible overall effectiveness score? _____

3.2.2 Feedback

1. How often (in weeks) did personnel get a feedback report? _____ Weeks

2. What was the average amount of elapsed time (in days) between the end of a measurement period and the personnel receiving the feedback report? _____ Days

3. Please check all of the items below which were included in the feedback report. (If something was given to the group as a whole but not to each individual such as putting up a figure showing the changes in effectiveness over time, consider that as part of the feedback report.):

_____ A list of products and indicators.
_____ The level of each indicator for the period.
_____ The effectiveness value for each indicator.
_____ The overall effectiveness score.
_____ Effectiveness data on products (i.e. the sum of the effectiveness scores for the indicators for each product).

Percent of maximum score(s):

_____ Percent of maximum was provided for the overall score.
_____ Percent of maximum scores were provided for products but not for individual indicators.
_____ Percent of maximum scores were provided for all indicators.

_____ Historical data; data on past feedback periods.
_____ The amount of change between the previous period(s) and the current data.
_____ Priority data; data showing the amount of change in effectiveness with changes in the indicators.
_____ Graphic representation of effectiveness or percent of maximum.
_____ Graphic representation of changes in overall effectiveness or percent of maximum over time.
_____ Other. Describe:_____

_____

4. What percentage of feedback reports were followed by a meeting to discuss the feedback report? _____%

5. What percentage of feedback meetings were conducted with the supervisor present? _____%

6. How long did the typical feedback meeting last? _____ minutes

How would you describe the content of the feedback meetings at the start of feedback and again after the personnel had experience with feedback meetings?

7. During initial feedback meetings what percent of the meeting time was characterized by the following behaviors. (These should sum to equal 100%):

_____ Constructive feedback about performance.
_____ Constructive attempts to identify problem causes.
_____ Constructive attempts to develop improvement strategies.
_____ Constructive discussions about future goals.
_____ Irrelevant discussion.
_____ Blaming and searching for excuses.
_____ Other positive discussion. Explain:
_____
_____ Other negative discussion. Explain: _____

8. After experience with feedback meetings what percent of the meeting time was characterized by the following behaviors. (These should sum to equal 100%):

_____ Constructive feedback about performance.
_____ Constructive attempts to identify problem causes.
_____ Constructive attempts to develop improvement strategies.
_____ Constructive discussions about future goals.
_____ Irrelevant discussion.
_____ Blaming and searching for excuses.
_____ Other positive discussion. Explain:
_____
_____ Other negative discussion. Explain: _____

9. **Was the setting in which the feedback meetings were held conducive to doing work?** (For example, a setting might be too noisy, too hot or cold, or has too many distractions.)

___ 5. Setting was conducive to doing work in all aspects.
___ 4.
___ 3. Setting had some characteristics that made working somewhat more difficult.
___ 2.
___ 1. Setting possessed elements which made it very difficult to work.

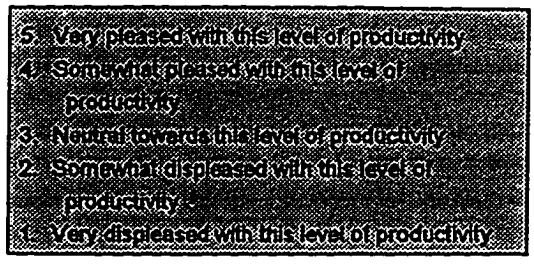
10. **During what time were feedback meetings conducted?**

___ 3. During normal working hours.
___ 2. Outside of normal working hours, with compensation.
___ 1. Outside of normal working hours, without compensation.

3.2.3 Other

We are interested in people's reaction to the expected levels. In some projects it seems the expected levels are seen by unit personnel as minimums that should be exceeded. In other cases, performing at the expected level seems perfectly comfortable to unit personnel. This could have an effect on the ultimate level of effectiveness. We would like to get a sense for how this was viewed in this project.

Consider the scale below:



1. Using the scale above, what would have been the reaction of the target unit personnel towards performing at:

	Reaction by Target Unit Personnel
Well below the expected level	_____
Slightly below the expected level	_____
At the expected level	_____
Slightly above the expected level	_____
Well above the expected level	_____

2. Indicate what you think management's reaction would have been to the target unit performing at the following levels (use the same ratings scale as before):

	Reaction by Management
Well below the expected level	_____
Slightly below the expected level	_____
At the expected level	_____
Slightly above the expected level	_____
Well above the expected level	_____

3. Indicate what you think the reaction of the supervisors would have been to the target unit performing at the following levels (use the same ratings scale as before):

	Reaction by Supervisors
Well below the expected level	_____
Slightly below the expected level	_____
At the expected level	_____
Slightly above the expected level	_____
Well above the expected level	_____

4. **How much time was required to maintain the system after it was implemented?** Indicate the number of person-hours per month to do each of the following.

_____ Collecting indicator data
_____ Putting feedback reports together
_____ Conducting feedback meetings
_____ Distributing feedback reports
_____ Other: Specify _____
_____ Other: Specify _____
_____ TOTAL HOURS

4. REACTIONS TO THE SYSTEM

What was the overall reaction of the personnel in the target unit to using the system (i.e. using feedback)?

1. Over the first 3 months?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

2. With 4 to 12 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

3. With 12 to 24 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

4. After 24 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

What were the supervisors' overall reaction to using the system (i.e. using feedback)?

5. Over the first 3 months?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

6. With 4 to 12 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

7. With 12 to 24 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

8. After 24 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

What was the management's overall reaction to using the system (i.e. using feedback)?

9. Over the first 3 months?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

10. With 4 to 12 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

11. With 12 to 24 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

12. After 24 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.

___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

What was the union/works committee's overall reaction to using the system (i.e. using feedback)?

13. Over the first 3 months?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

14. With 4 to 12 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

15. With 12 to 24 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

16. After 24 months experience with the system?

___ 5. Quite positive. They liked the system and did not see any serious problems.
___ 4.
___ 3. Mixed. They liked some aspects of the system but felt there were some problems.
___ 2.
___ 1. Quite negative. They felt there were serious problems that could not easily be overcome.
___ 0. Not applicable, system is/was not implemented or has not been in operation this long.

17. **What degree of changes needed to be made to the original system over the first 6 months of feedback?** Changes include revising contingencies, changing measures, doing feedback reports differently, etc. Minor changes include changing the expected level on a contingency or adding a graphic to the feedback report. Major changes are done in response to a serious problem such as finding out the indicator data are very different than what was thought.

___ 5. Many major changes had to be made
___ 4. Several major changes had to be made
___ 3. A major change had to be made
___ 2. Only minor changes had to be made
___ 1. No changes had to be made

18. What degree of changes needed to be made to the original system after the first 6 months of feedback? Changes include revising contingencies, changing measures, doing feedback reports differently, etc. Minor changes include changing the expected level on a contingency or adding a graphic to the feedback report. Major changes are done in response to a serious problem such as finding out the indicator data are very different than what was thought.

___ 5. Many major changes had to be made
___ 4. Several major changes had to be made
___ 3. A major change had to be made
___ 2. Only minor changes had to be made
___ 1. No changes had to be made
___ 0. System has not yet run for six months

19. What problems came up during the implementation of feedback? (Check all that apply.)

___ Target unit personnel did not see the measures as valid
___ Supervision/management did not see the system as valid
___ Target unit personnel did not understand the system
___ Supervision/management did not understand the system
___ Target unit personnel did not feel the system was being administered according to the agreements made at the start of the project (e.g. being used for performance appraisal before all agreed to do that.)
___ Feedback reports were delayed
___ Feedback meetings were poorly attended by target unit personnel
___ Feedback meetings were poorly attended by supervisors
___ Planned feedback meetings were not held
___ Feedback meetings were not handled well by the supervisor
___ The project was not perceived as getting continued management support
___ Other (describe)

_____

_____

20. What decisions were made about using ProMES:

_____ 5. The organization contributed resources for projects involving the entire organization.
_____ 4. The organization contributed resources for projects involving other units within the organization, but not the entire organization.
_____ 3. The organization expressed an interest or desire for future projects, but has not committed any resources.
_____ 2. The organization plans to continue the current project, but has no plans for any future projects.
_____ 1. The organization has stopped the project, and does not appear to be interested in doing any more ProMES work.

Likes and dislikes about the system. This next section asks about things target unit personnel, management and the union/works committee liked and disliked about the system. You might not have detailed information on many of these issues, but we are asking for any factors that were discussed by these groups in a way that made them seem like meaningful issues. Also, not everyone will feel the same way. We are asking if a significant number of people felt these were issues.

21. What did target unit personnel like about the system? (Check all that apply.)

____ Clarified what was important
____ Clarified priorities
____ Improved productivity
____ Improved attitudes of target unit personnel
____ Reduced stress
____ Reduced wasted effort
____ Made unit easier to manage
____ Made units more accountable
____ Gave management more control
____ Gave target unit personnel more control
____ Was a cost effective way to improve productivity
____ Could monitor productivity more easily
____ Allowed target unit personnel to participate in decision making
____ Gave target unit personnel better feedback
____ Allowed target unit personnel the chance to fix problems before they became serious
____ Gave target unit personnel information to better know what to work on to improve things
____ Allowed target unit personnel the chance to make improvements
____ Provided the information to give recognition for good work
____ Other: (Describe) _____

_____

22. What did management/supervision like about the system? (Check all that apply.)

____ Clarified what was important
____ Clarified priorities
____ Improved productivity
____ Improved attitudes of target unit personnel
____ Reduced stress
____ Reduced wasted effort
____ Made unit easier to manage
____ Made units more accountable
____ Gave management more control
____ Gave target unit personnel more control
____ Was a cost effective way to improve productivity
____ Could monitor productivity more easily
____ Allowed target unit personnel to participate in decision making
____ Gave target unit personnel better feedback
____ Allowed target unit personnel the chance to fix problems before they became serious
____ Gave target unit personnel information to better know what to work on to improve things
____ Allowed target unit personnel the chance to make improvements
____ Provided the information to give recognition for good work
____ Other: (Describe) _____

_____

23. What did the union/works committee like about the system? (Check all that apply.)

____ Clarified what was important
____ Clarified priorities
____ Improved productivity
____ Improved attitudes of target unit personnel
____ Reduced stress
____ Reduced wasted effort
____ Made unit easier to manage
____ Made units more accountable
____ Gave management more control
____ Gave target unit personnel more control
____ Was a cost effective way to improve productivity
____ Could monitor productivity more easily
____ Allowed target unit personnel to participate in decision making
____ Gave target unit personnel better feedback
____ Allowed target unit personnel the chance to fix problems before they became serious
____ Gave target unit personnel information to better know what to work on to improve things
____ Allowed target unit personnel the chance to make improvements
____ Provided the information to give recognition for good work
____ Other: (Describe) _____

_____

24. What did target unit personnel dislike about the system? (Check all that apply.)

____ Took too much time to develop
____ Too costly to develop
____ Needed too many resources to maintain
____ System was hard to understand
____ Did not feel they had enough input into the final system
____ Made them accountable for their work
____ Created expectations of them that were too high
____ Gave them too much responsibility
____ System created new problems that were not there before (Please explain what these were.)

_____

_____

_____

____ Other: (Describe) _____

_____

25. What did management/supervision dislike about the system? (Check all that apply.)

____ Took too long to develop
____ Too costly to develop
____ Needed too many resources to maintain
____ System was hard to understand
____ Did not feel they had enough input into the final system
____ Management seemed to lose control
____ Allowed target unit personnel too much control over decision making
____ Incumbents wanted more rewards after the system was implemented
____ System created new problems that were not there before (Please explain what these were.)

_____
_____
_____

____ Other: (Describe) _____
_____

26. What did the union/works committee dislike about the system? (Check all that apply.)

____ Took too much time to develop
____ Too costly to develop
____ Needed too many resources to maintain
____ System was hard to understand
____ Did not feel they had enough input into the final system
____ Made them accountable for their work
____ Created expectations of them that were too high
____ Gave them too much responsibility
____ System created new problems that were not there before (Please explain what these were.)

_____
_____
_____

____ Other: (Describe) _____
_____

27. Please check the most applicable description of the project:

____ 1. System development was started, but never completed.
____ 2. System was completed, but never implemented.
____ 3. Developed system was implemented, but was discontinued after _____ months of operation.
____ 4 Developed system is still in use after _____ months of operation.
____. 5. Other (describe) _____

If the developed system is not still in use, please explain why it was discontinued.

_____
_____
_____
_____
_____
_____
_____

5. PROJECT DATA

5.1 DESCRIPTIVE INFORMATION

1. **How many months of baseline data are available for the target unit? _____ Months**

2. **How many periods of baseline data are available for the target unit?** (A "period" is the time unit used for the feedback reports, e.g. weeks, months, etc.) **_____ Periods**

3. **How many months of feedback data are available for the target unit? _____ Months**

4. **How many periods of feedback data are available for the target unit? _____ Periods**

5. **What type of comparison/control group was used?**
   - ___ 1. True control group(s) (Groups were randomly assigned to experimental and control groups, all groups did the same work in essentially the same conditions.)
   - ___ 2. Nonequivalent control group(s). Other non-randomly assigned units or units doing different work but in the same part of the organization or similar organization.
   - ___ 3. Groups which were given a treatment other than that of the experimental group, such as another measurement system.
   - ___ 4. No comparison group.
   - ___ 5. Other. Describe :_____

6. **Name(s) of the comparison group(s):** (I.e. names that we can use to uniquely identify the specific comparison groups. Analogous to a Target Unit Name.)

5.2 NEEDED PROJECT DATA

We need a variety of types of data for each target unit. These are described below.

- A copy of Objectives (Products) and Indicators including for each target unit:
  - Name
  - Description
  - Clear indication of which Indicators go with which Objectives
- A copy of the contingencies.
- Size of the change interval for each indicator, if used. This is the number of units on an indicator that is used to increase the current level of the indicator when calculating changes in effectiveness (priority information) for the ProMES Report Generating Program.
- A copy of a feedback report used with the target unit.
- Indicator data for each time unit (e.g. week, month, etc.). A form (ProMES Data Table) is provided for these data.
  - Date of that time period
  - Experimental condition for that time period (e.g. baseline, feedback, etc.)
  - Value of each indicator
  - Effectiveness values for each indicator value
  - Overall effectiveness score
- Explanation of each experimental condition.
- Productivity data for the control/comparison units, by time period.
- Copy and explanation of any attitude data that were collected.
- Any anecdotal information that you feel is important.
- Any explanations for unusual results. (E.g. why effectiveness showed a large drop at one point in time).
- Any unusual conditions or problems that would help in interpreting the data. For example, there was a large amount of turnover in time period X, an accident occurred in period Y, major revisions to the system had to be done from period N to N+, etc.

ProMES Data Table

In order to help us code the data, please complete the attached ProMES Data Table for each project. Most projects will take multiple pages for the data, so indicate which Page this is of the Total Pages. Put the date of each time period in the Date columns. If the data are available in weeks, this would be dates 7 days apart. For each date, note what activity was going on, using the Experimental Condition categories below. Add any explanatory information in the form of notes that you feel will help us understand the data. Fill out a questionnaire for each ProMES target unit and one for the control/comparison units.

Note: If you have this data in another format (e.g. on computer disk) from which we can easily extract the necessary information, you can send it to us in this format rather than completing the data table. However, please give us enough information to be able to understand what the data represent.

Experimental Conditions

It is critical that we know which data go with which interventions, or experimental conditions. To make this clear, please use the following system. Below are some typical categories in ProMES projects such as baseline, feedback, etc. They are numbered. Use these numbers on the ProMES Data Table to tell us what was going on during that time. Add explanatory notes if needed. Also, note that there are several numbered options that are blank. If one or more of your conditions is not on the list, add them here with an explanation. For example, if you had a goal setting condition, write Goal Setting in the blank by #5 and use 5 for those data time periods that were during the goal setting intervention. Also add a paragraph explaining the treatment.

It is possible you might need to break down a condition on the list into subcategories. For example, suppose you had feedback with only some of the indicators for a time, then later feedback with all of them. To communicate this, use the condition number and a, b, c, etc. for the subcategories. For example, partial feedback would be 4a, complete feedback would be 4b. Explain what your notation means and use this labeling system in the ProMES Data Table.

1. Pre-Baseline. Prior to any contact by ProMES researchers. This is typically before the baseline starts. It is data collected from historical records from before the start of the project.
2. System development. Data from the period of time when the system was being developed by the design team.
3. Baseline. Data from when the system has been developed, but no feedback has started.
4. Feedback. Data during the ProMES feedback period.
5. Other: _____ (Describe in a paragraph or so what interventions were going on e.g. goal setting.)
6. Other: _____
7. Other: _____
8. Other: _____

USE EXTRA DATA TABLE SHEETS IF NECESSARY

PROMES DATA TABLE

Parent or Local Organization Name:	Date this form was completed:	Page _____ of _____ total pages	Data are for: ___ ProMES unit ___ Comparison unit
Target Unit Name:	Target Unit ID Number (added by Pritchard):	If a comparison unit, which ProMES units do data apply to:	

Experimental Conditions: 1= Pre-baseline 2=Development 3=Baseline 4=Feedback 5=Other: _____ 6=Other: _____

MEASURES	Experimental condition: _____		Experimental condition: _____		Experimental condition: _____		Experimental condition: _____		Experimental condition: _____		Experimental condition: _____	
	Date:		Date:		Date:		Date:		Date:		Date:	
	Ind. Value	Effectiv.	Ind. Value	Effectiv.	Ind. Value	Effectiv.	Ind. Value	Effectiv.	Ind. Value	Effectiv.	Ind. Value	Effectiv.
OVERALL EFFECTIVENESS:→												
INDICATORS												

APPENDIX C

RESEARCHERS CONTRIBUTING FEEDBACK TO DEVELOPMENT OF DATABASE INSTRUMENT

Researcher	Affiliation	Country
Winfred Arthur Jr.	Texas A & M University	U.S.A.
Jen A. Algera	Hoogovens Steel Works and Eindhoven Technical University	Netherlands
Ad van Berkel	Eindhoven Technical University	Netherlands
Karlease Clark	Food Safety and Inspection Service, Dept. of Agriculture and Texas A & M University	U.S.A.
Noga Gottesfeld	Texas A & M University	Israel
Yuri Henken	Institute for Olympic Research	Finland
Paul Janssen	Eindhoven Technical University	Netherlands
Steven D. Jones	Middle Tennessee State University	U.S.A.
Uwe Kleinbeck	University of Dortmund	Germany
Ad Kleingeld	Eindhoven Technical University	Netherlands
Kenneth Malm	Previa-Rikshälsan	Sweden
Henriette Miëdema	University of Amsterdam	Netherlands
Robert D. Pritchard	Texas A & M University	U.S.A.
Philip L. Roth	Clemson University	U.S.A.
Klaus-Helmut Schmidt	Institut für Arbeitsphysiologie and Universität Dortmund, Abteilung Arbeitspsychogie	Germany
Henk Thierry	University of Tilburg	Netherlands
Harrie van Tuijl	Eindhoven Technical University	Netherlands
Margaret D. Watson	LaSalle University	U.S.A.

APPENDIX D

EFFECTIVENESS OVER TIME PLOTS OF ORGANIZATIONAL UNITS

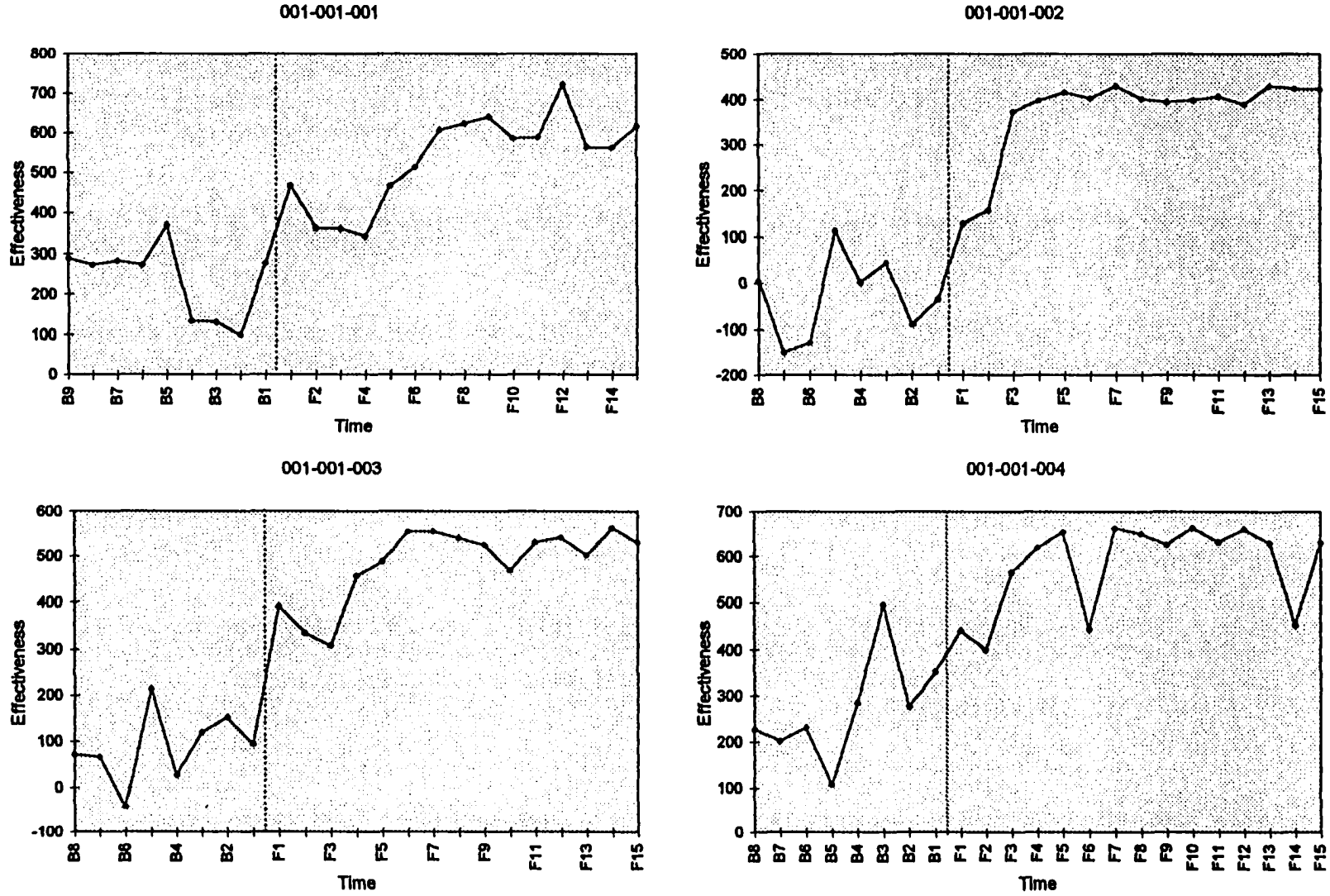


Figure D1. Effectiveness over time plots

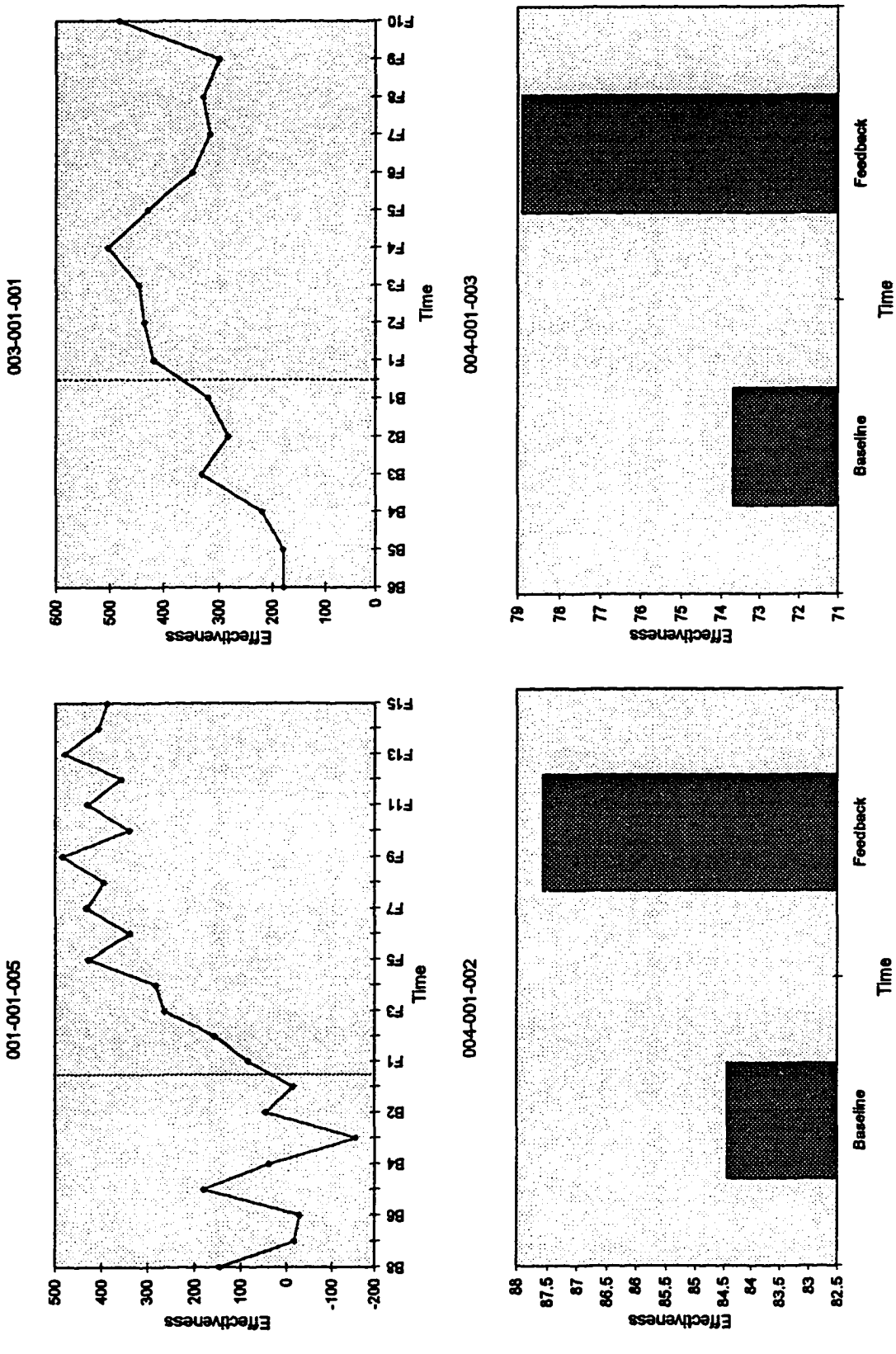
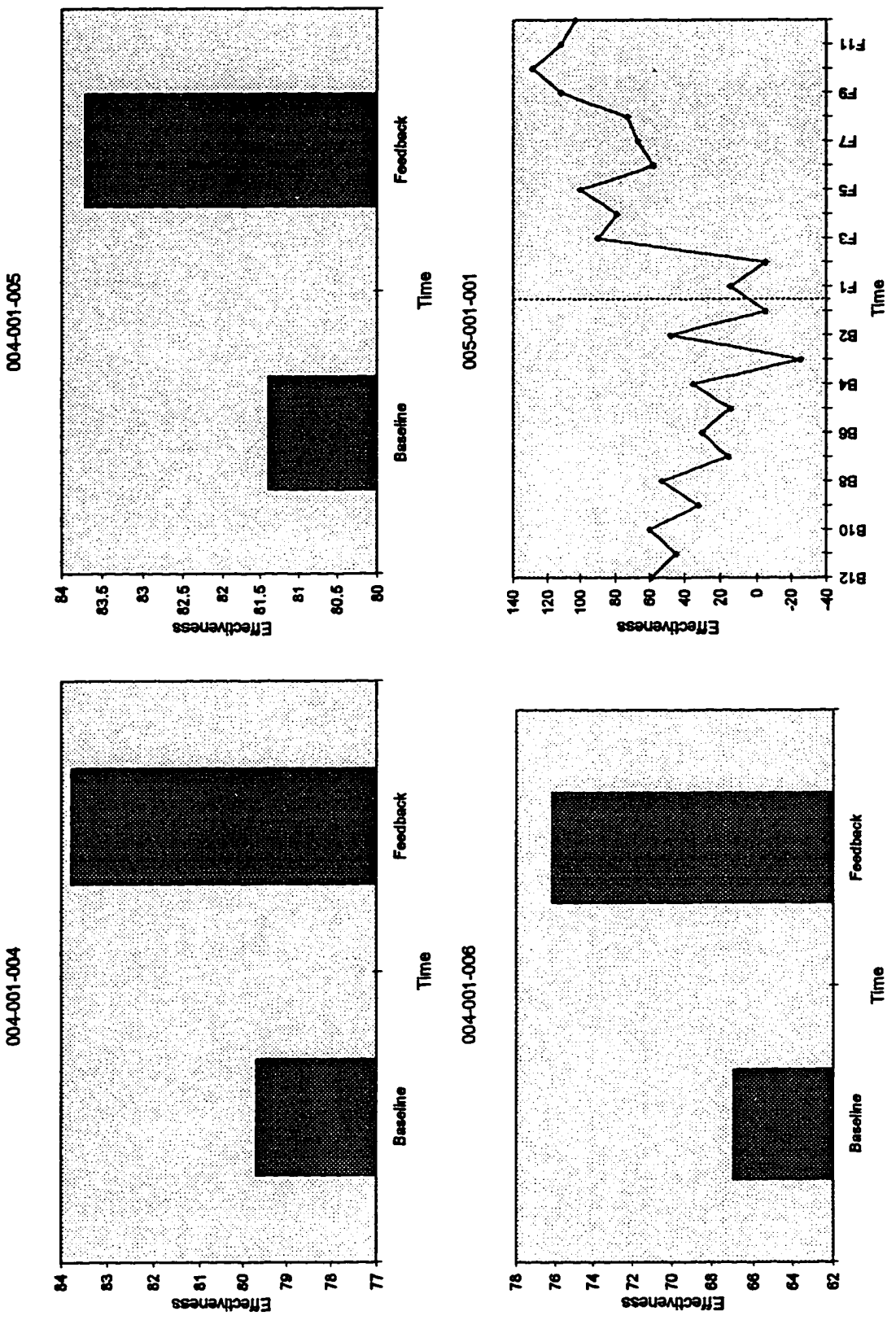


Figure D1 (Cont.).



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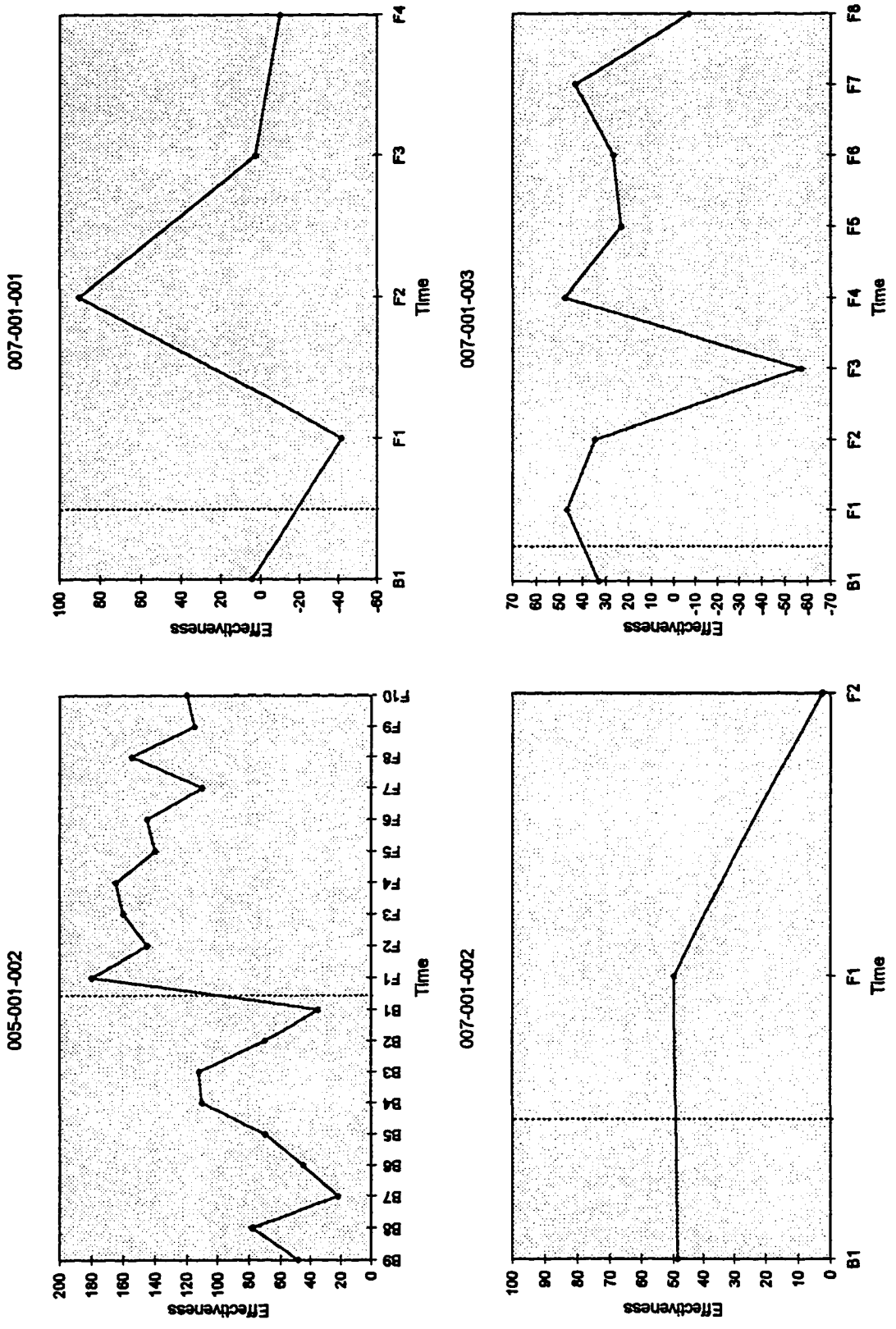

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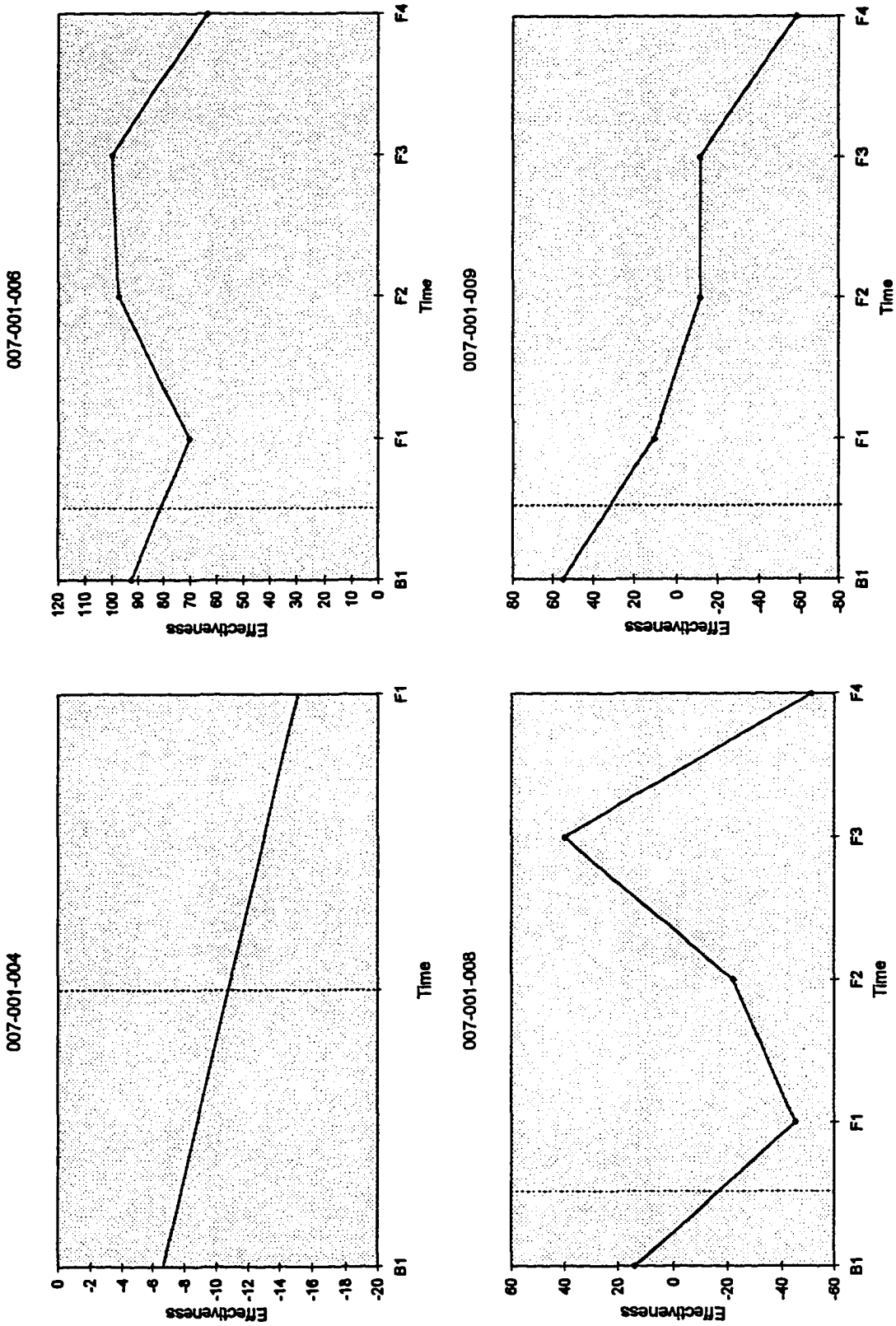

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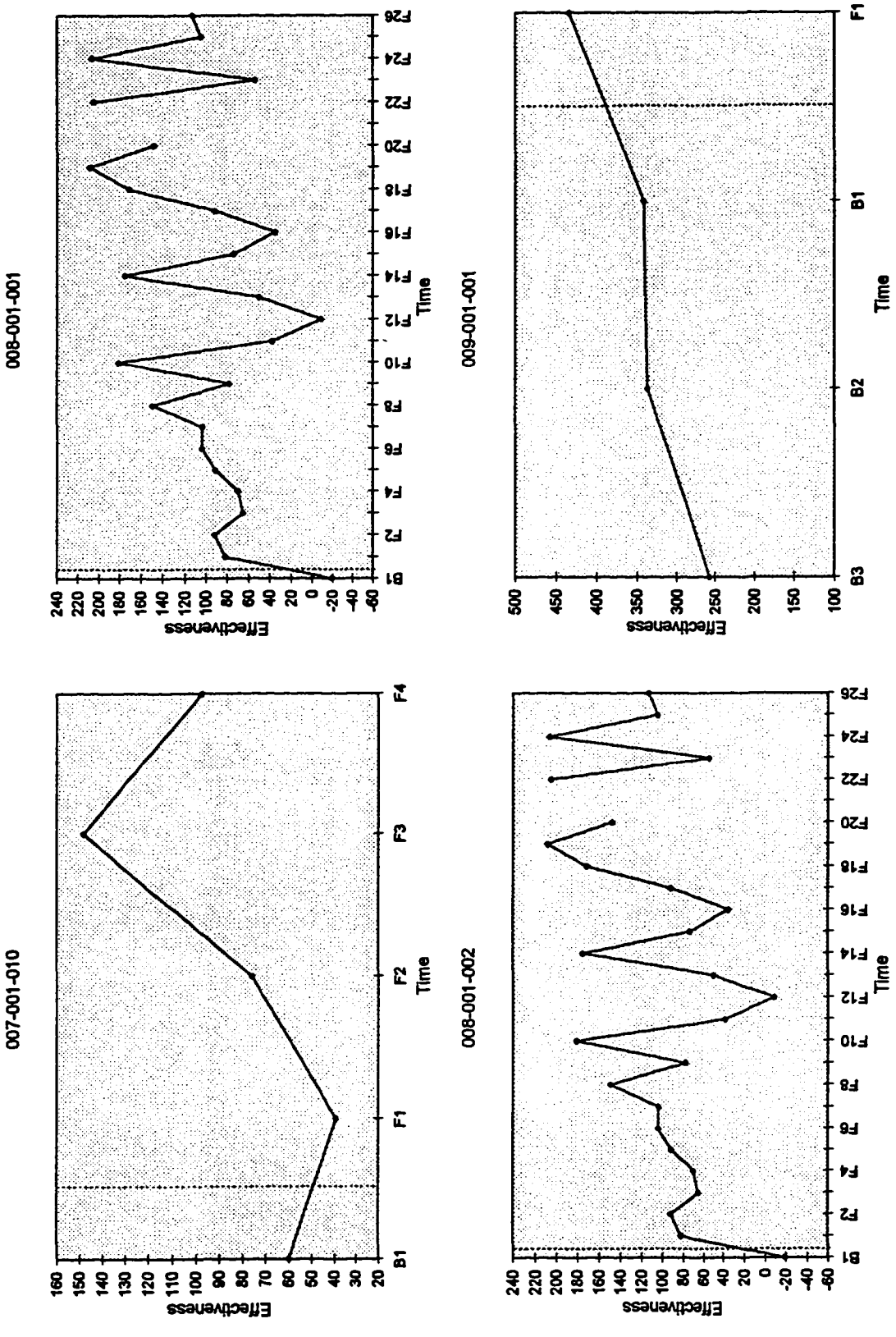

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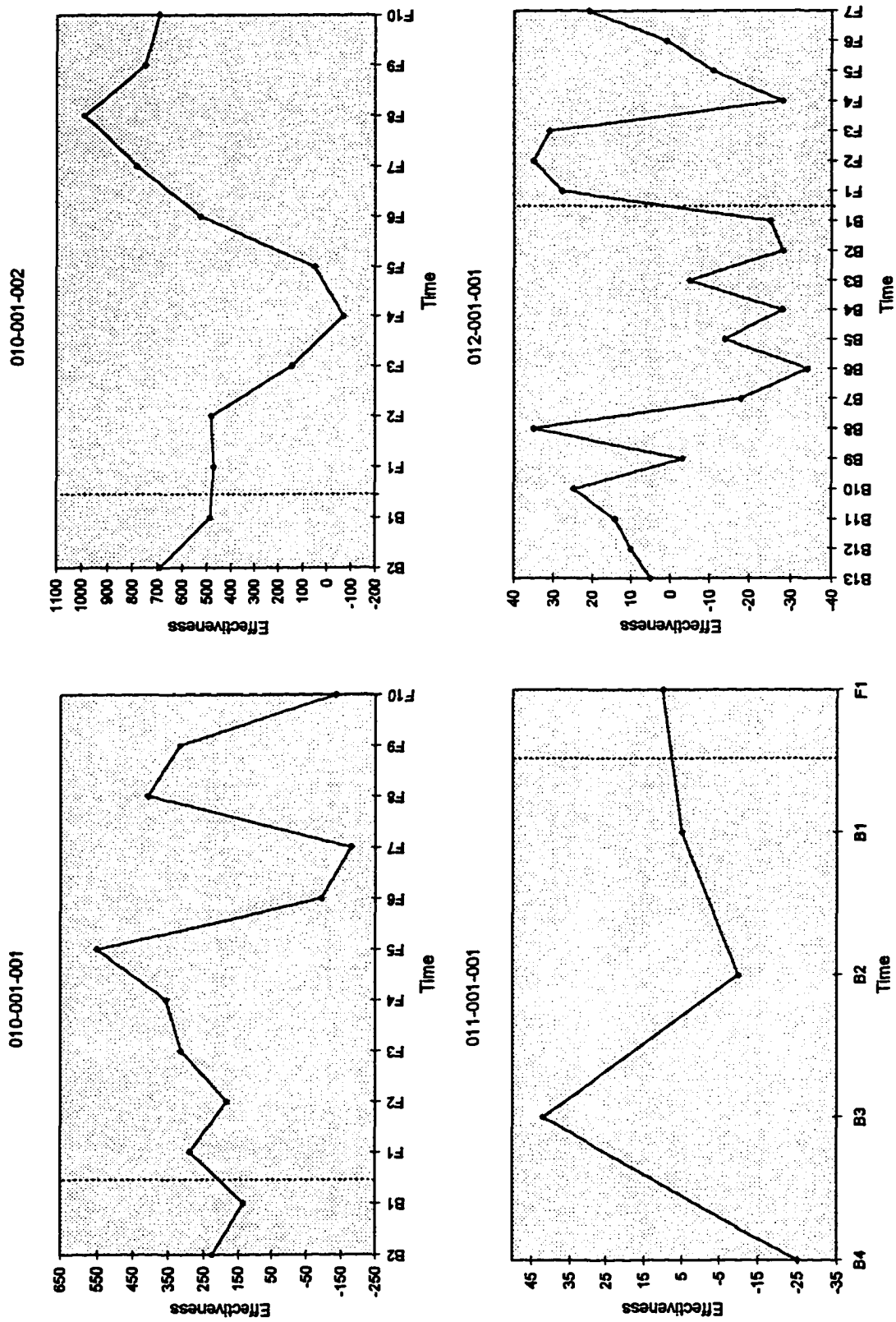

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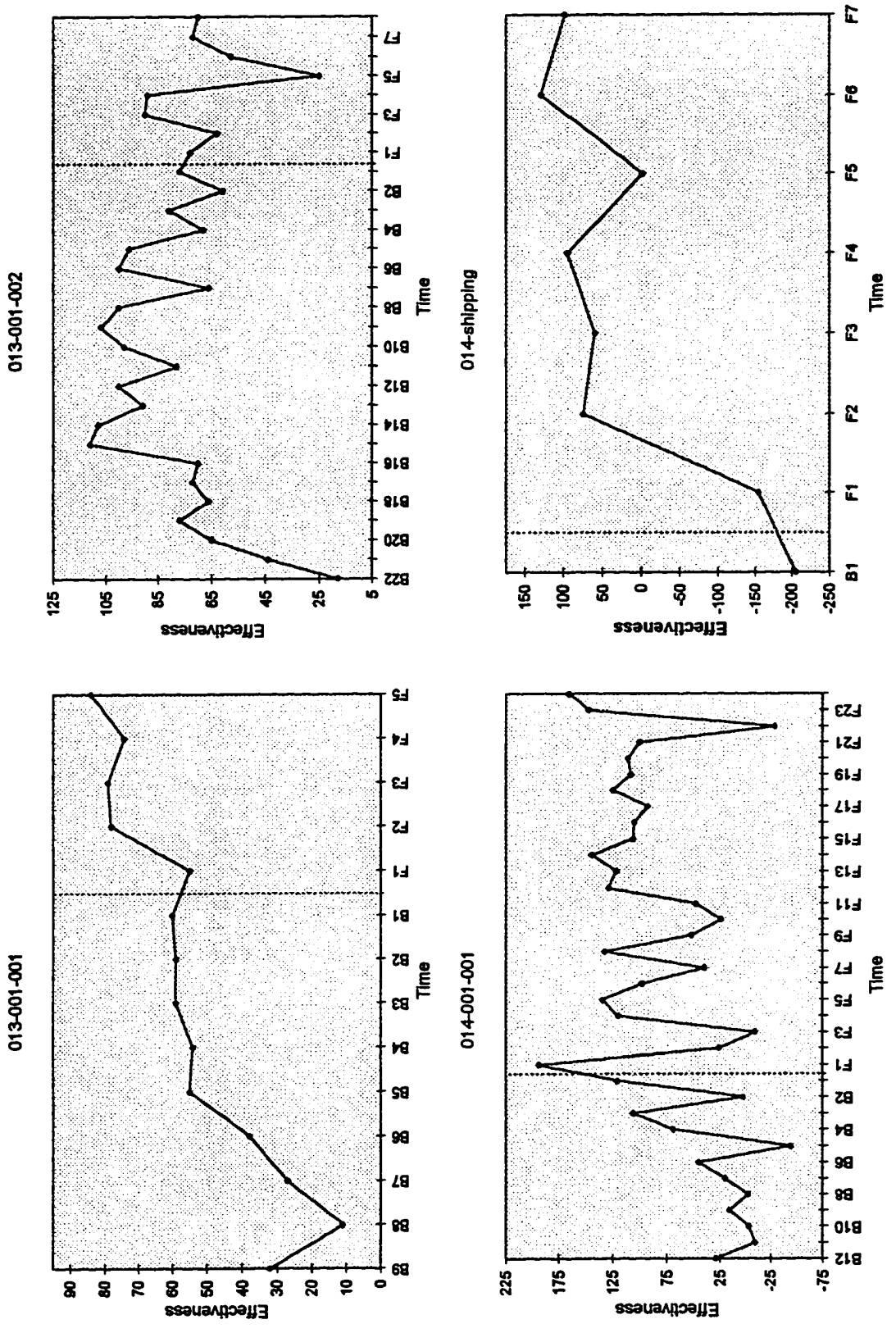
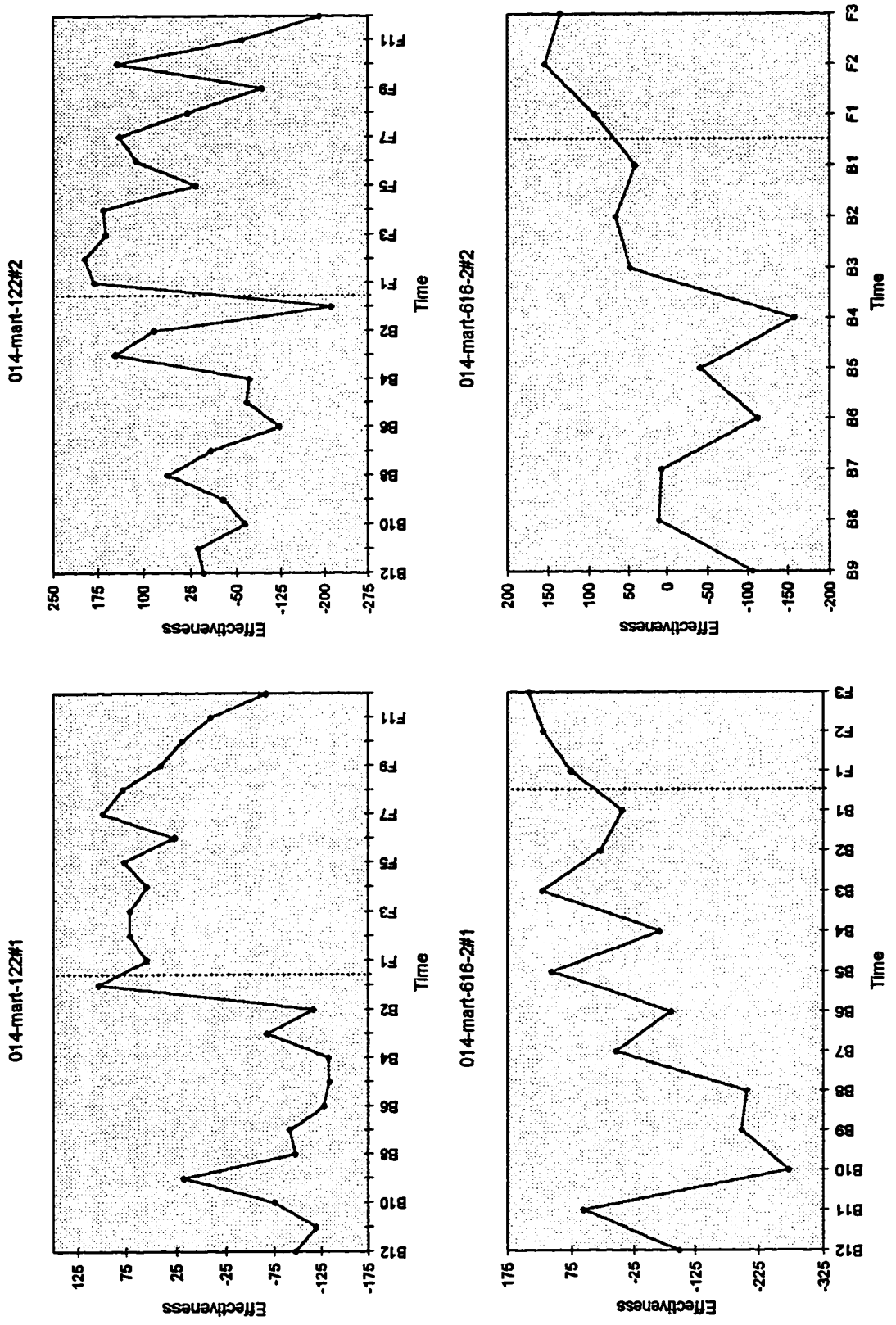


Figure D1 (Cont.).



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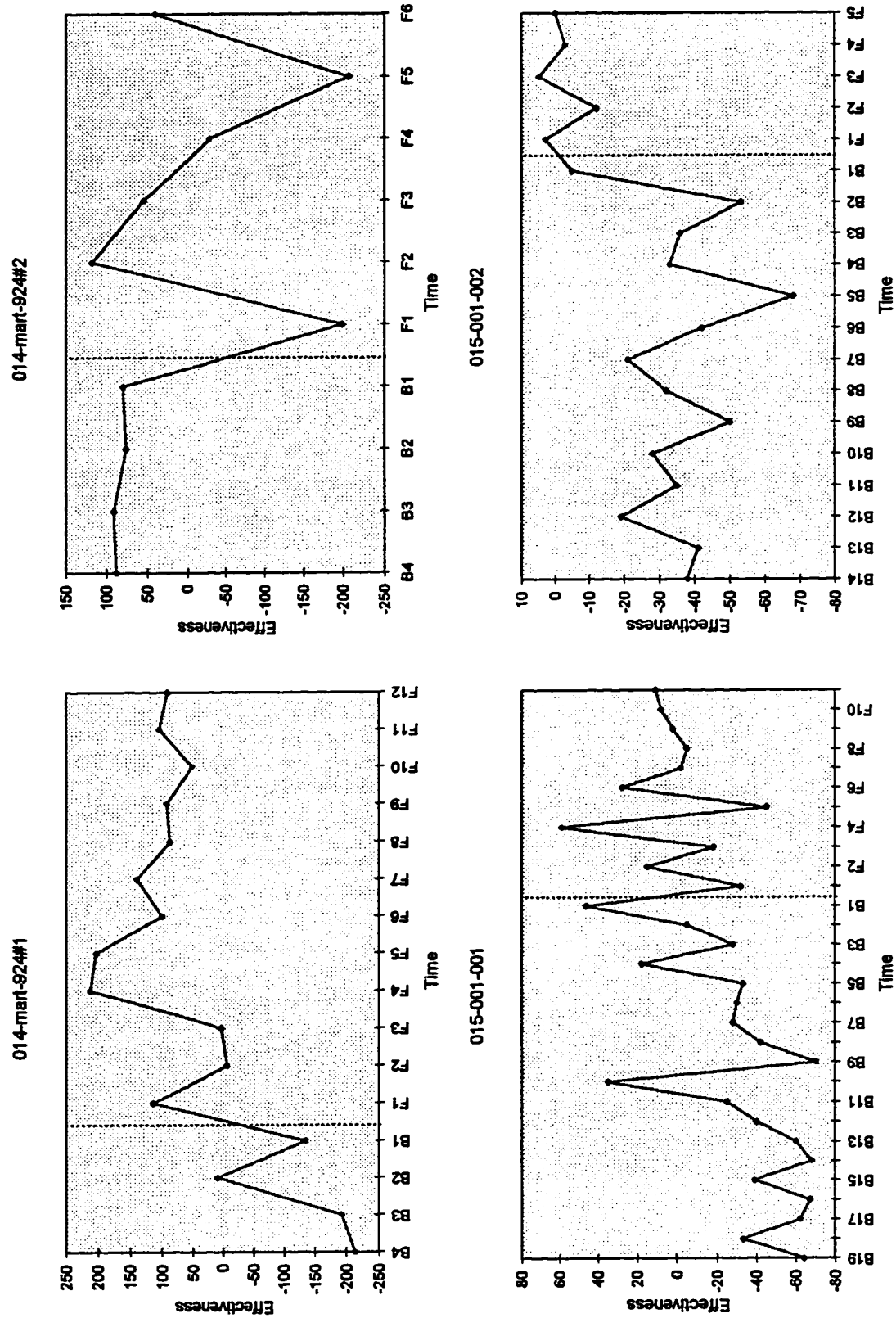

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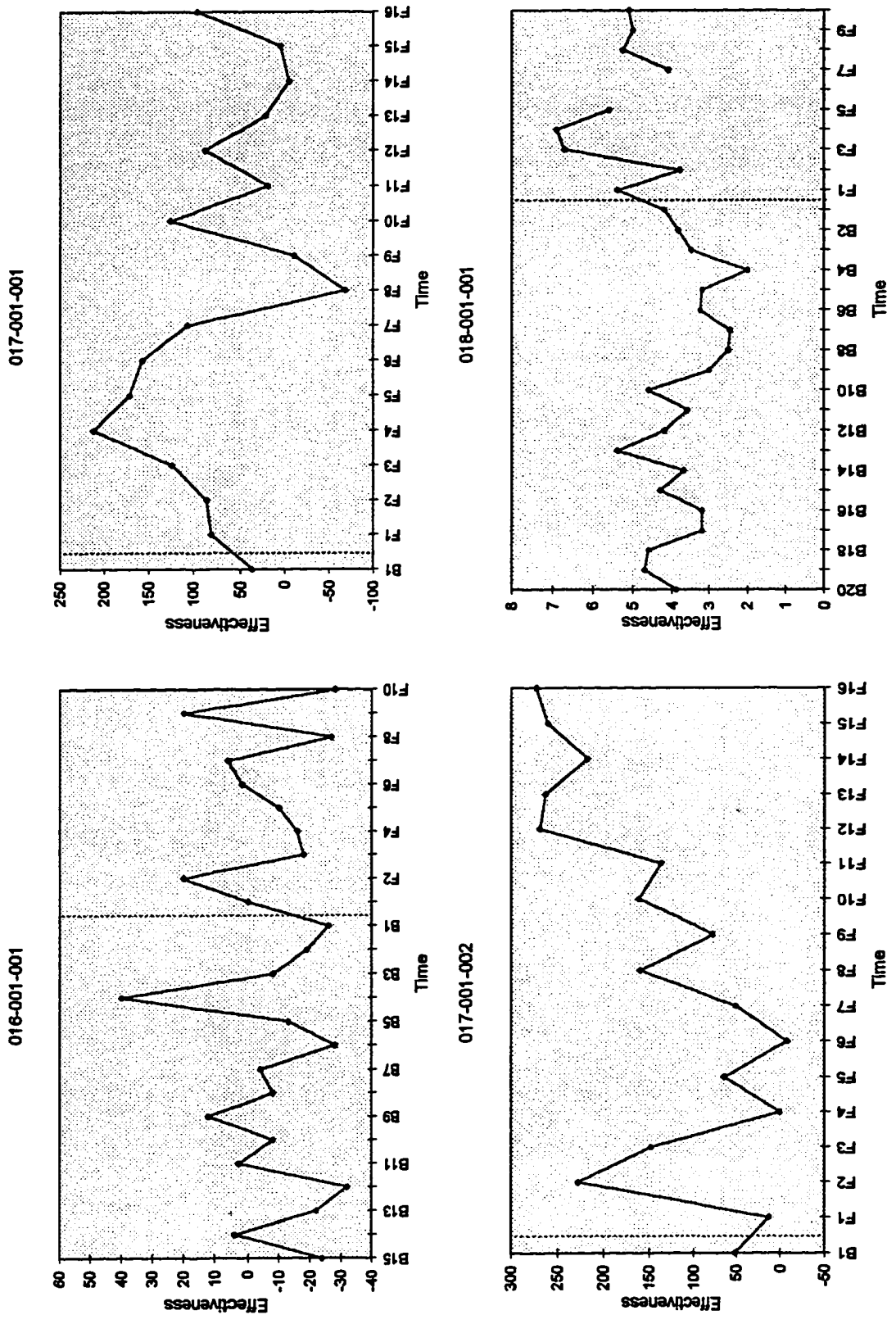


Figure D1 (Cont.).

APPENDIX E

EFFECTIVENESS OVER TIME PLOTS OF CASES WITH OBSERVABLE PLATEAUS

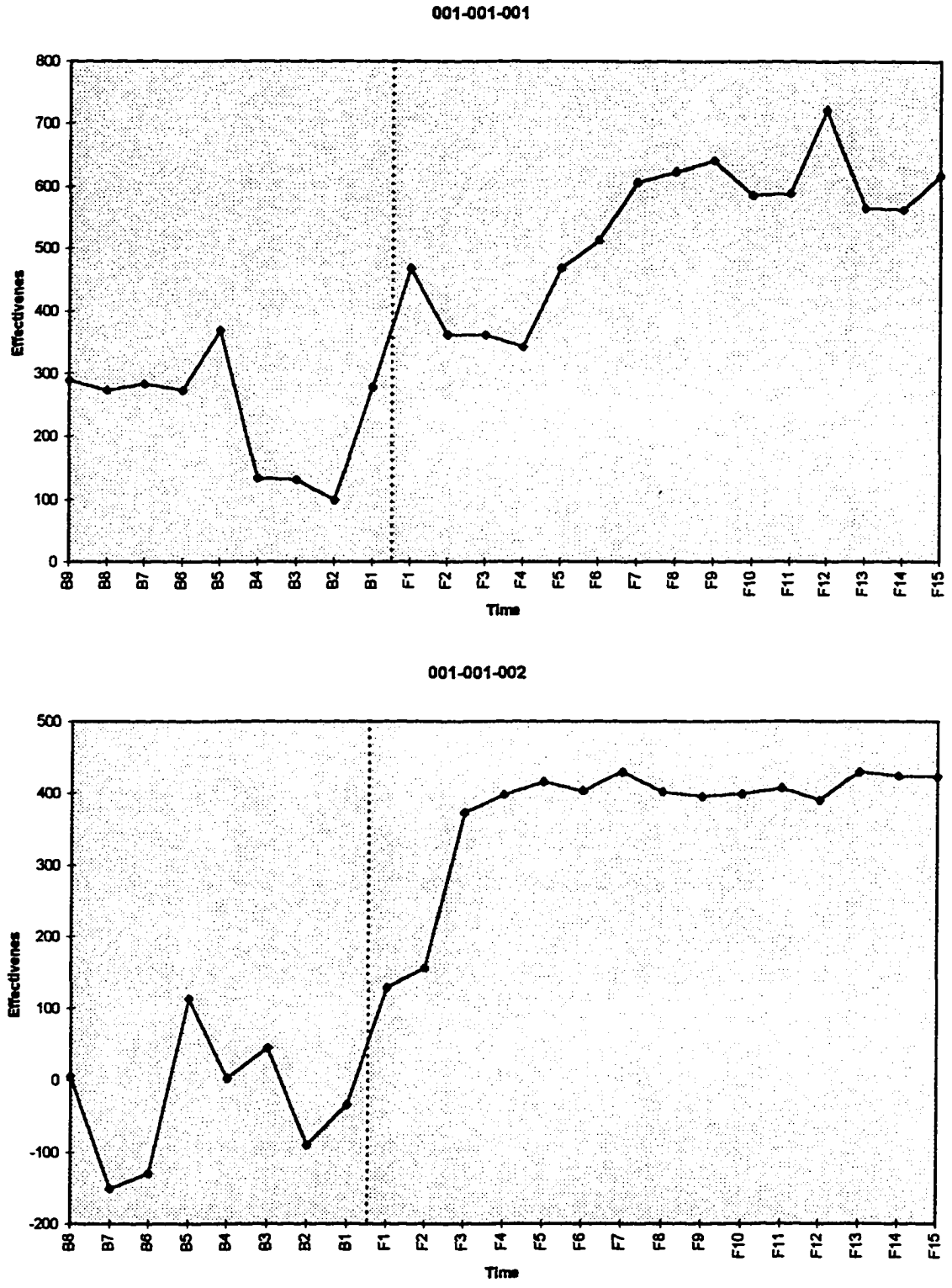


Figure E1. Effectiveness over time plots of cases with observable plateaus.

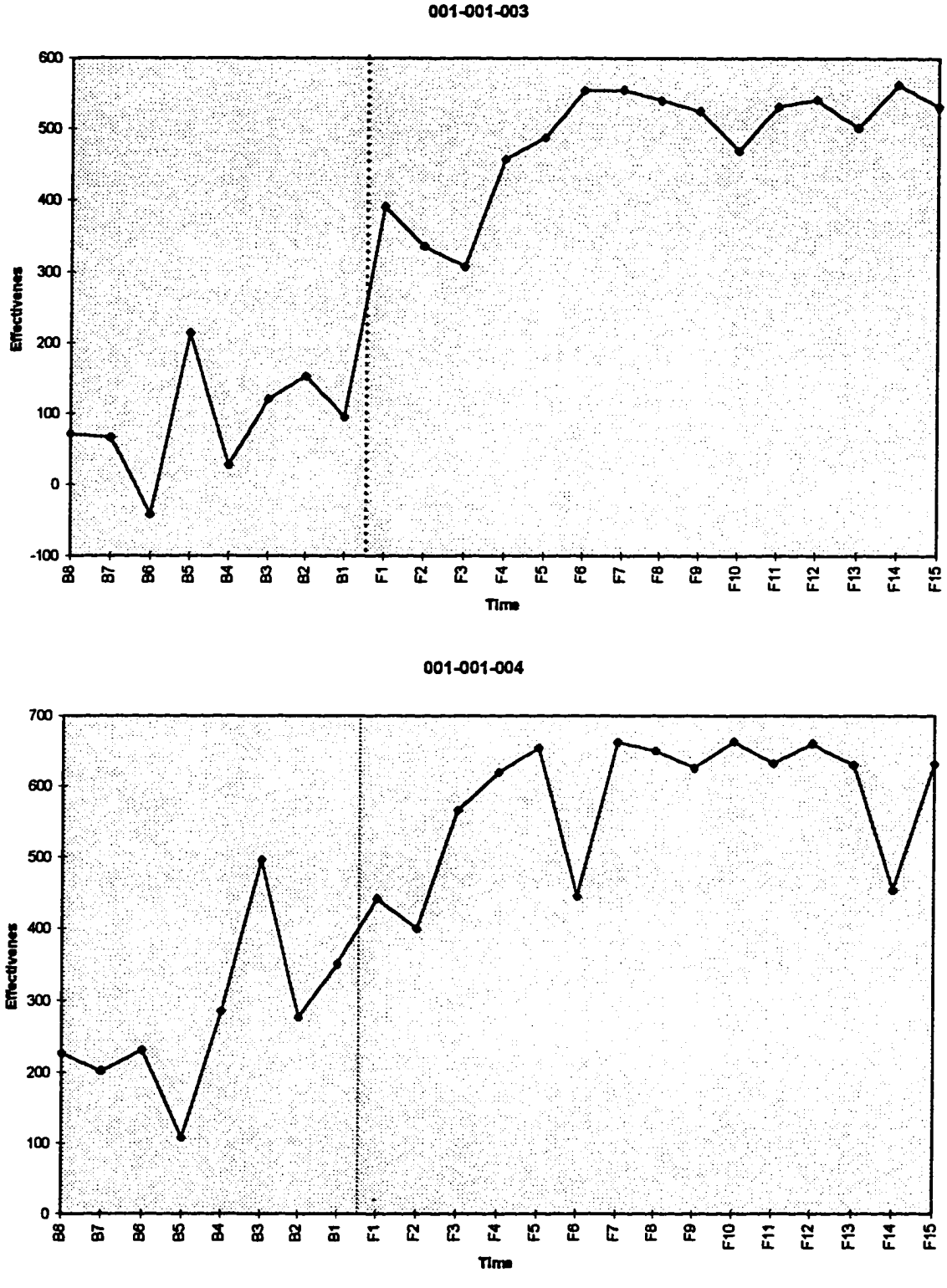
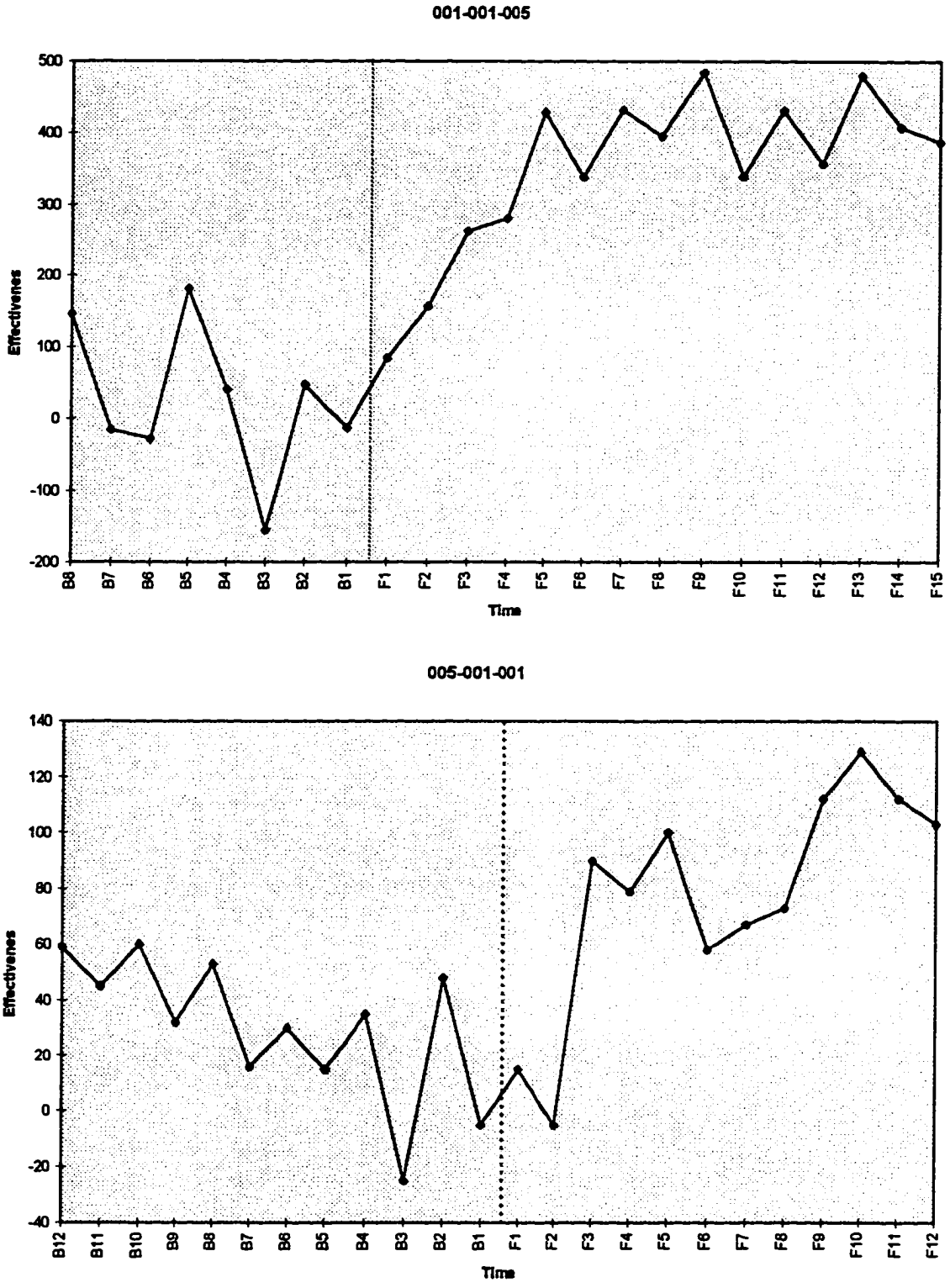


Figure E1 (Cont.).



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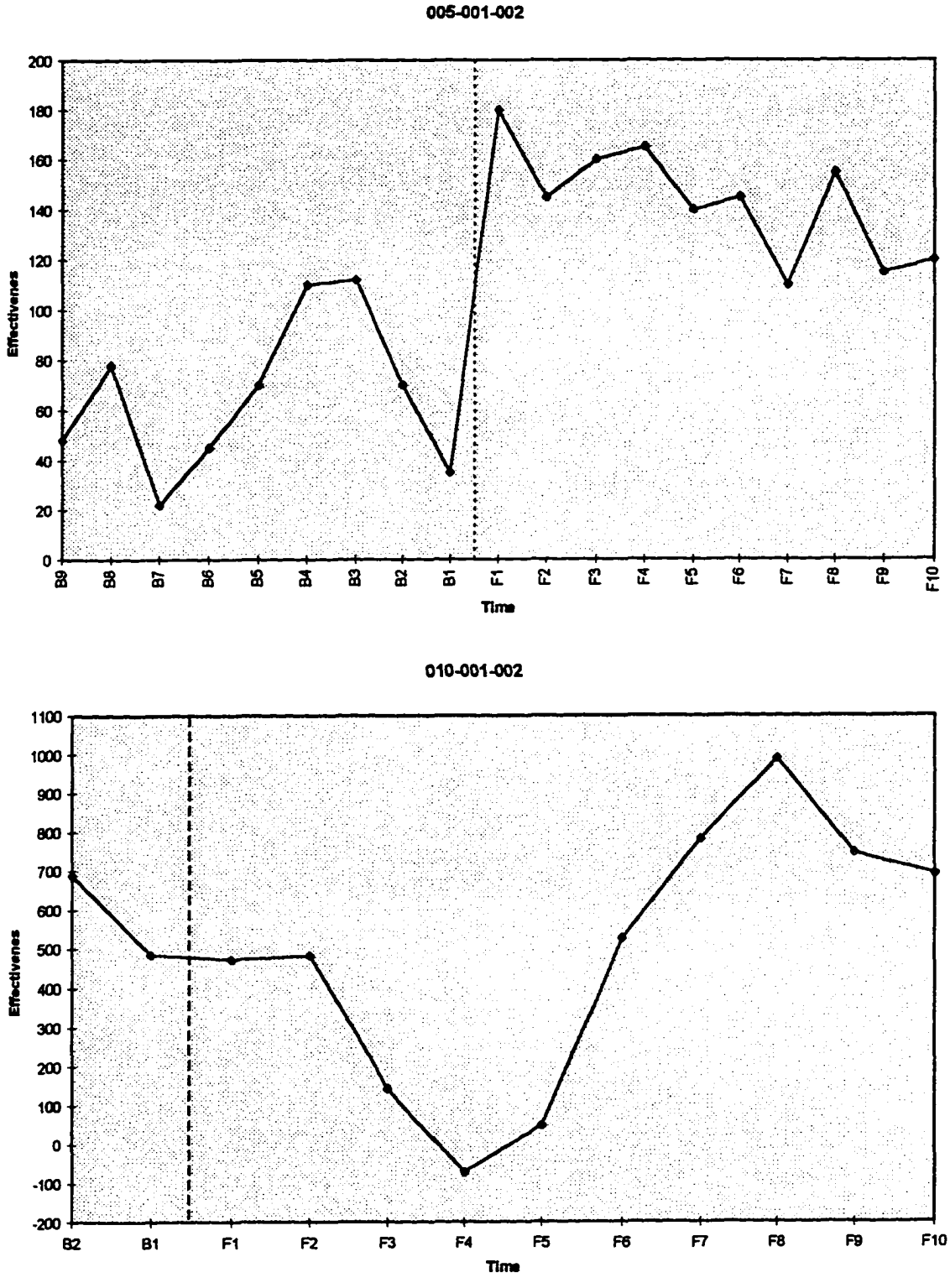
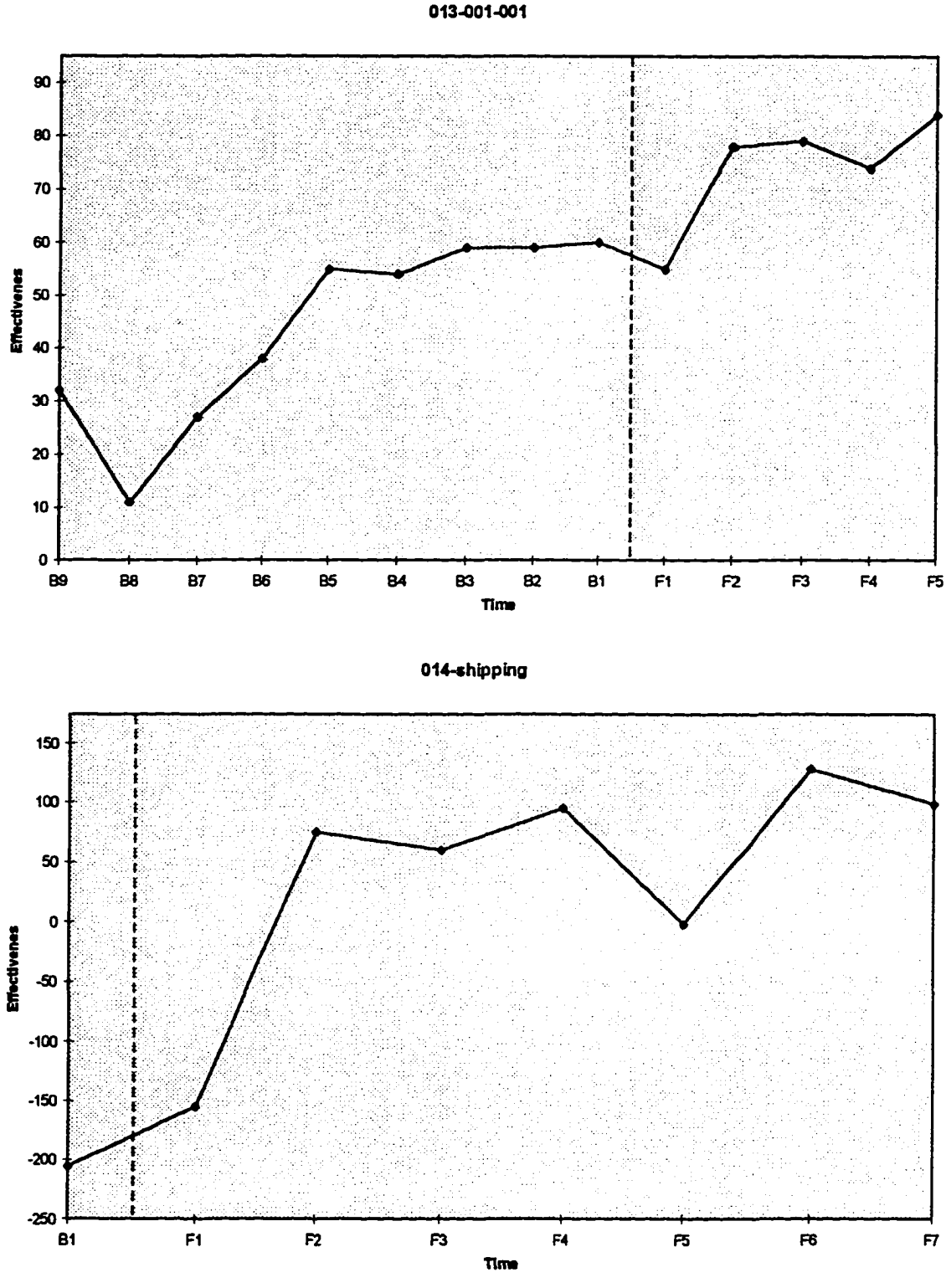


Figure E1 (Cont.).



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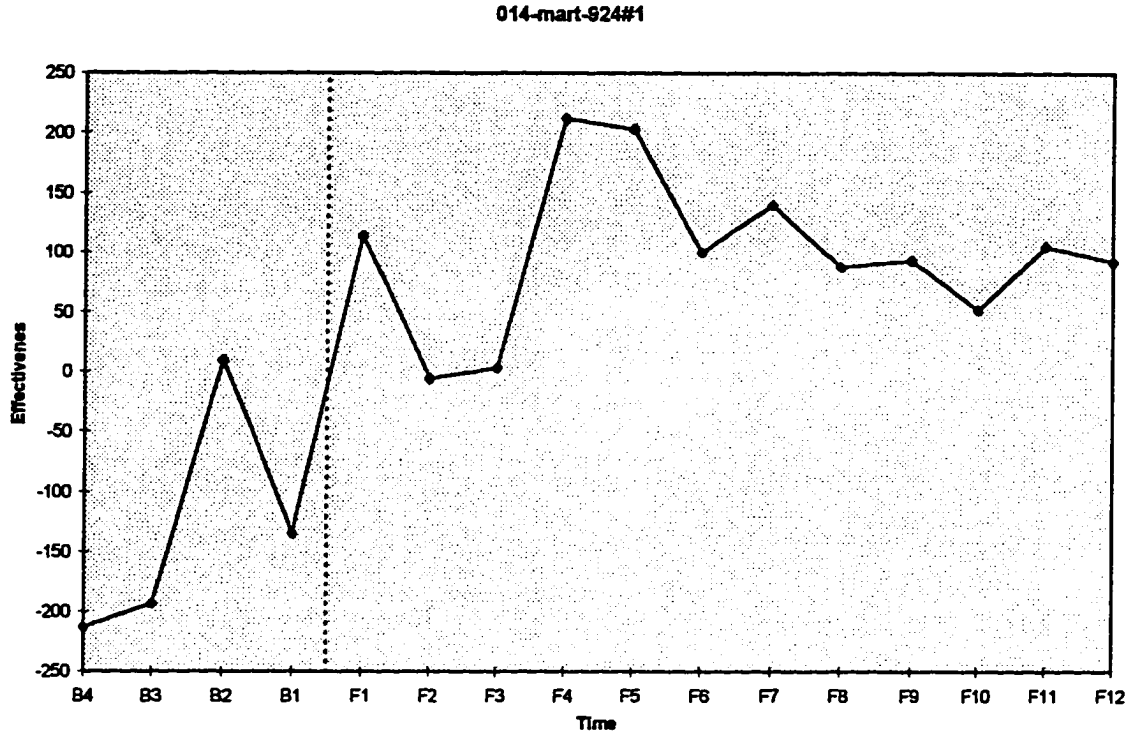

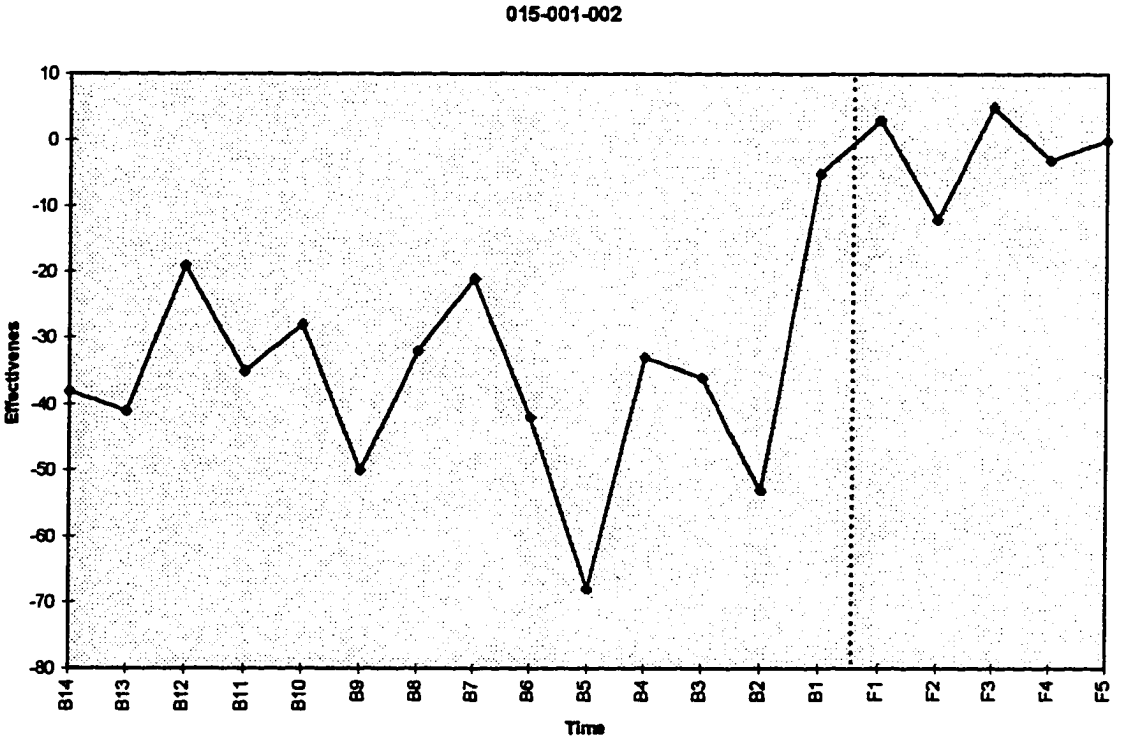

Figure E1 (Cont.).

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