Let's reflect on processes : task uncertainty as a moderator for feedback effectiveness

Let's Reflect on Processes:

Task Uncertainty as a Moderator for Feedback Effectiveness

Eric van der Geer - Rutten - Rijswijk

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Chapter 1

Introduction

Ever since feedback interventions have been introduced in organizations to enhance the work motivation of employees, the focus has mainly been on the final results of tasks. The general contention thus far has been that providing employees with information about their performance on the final results of their work increases their performance, and emerging performance management systems in health care have also adopted this point of view. However, over the last few decades, researchers have come to realize that the effects of feedback have been far from consistent and that this traditional focus on task outcomes has not always been effective. The present dissertation aims to contribute to the understanding of these important findings and examines several until now underexplored moderating conditions for feedback effectiveness. Special consideration is given to the potentially moderating variables task uncertainty, type of feedback, and reflection on feedback.

Defining and enhancing employee performance has recently become increasingly important for health care organizations, because of the need to more and more adjust to free-market conditions (e.g., Begley, Aday, Lairson, & Slater, 2002). Performance management interventions such as feedback are therefore strongly emerging in this field of work (e.g., Campbell, Roland, & Buetow, 2000). However, when task uncertainty plays an important role, such as often is the case with the treatment of patients (e.g., Franco, Bennett, & Kanfer, 2002), a focus on outcomes might not always be justified and might even be ineffective when

the goal is to enhance employee performance (Hirst, 1987). The purpose of the research presented in this dissertation is to examine how uncertainty in a task influences the effectiveness of different types of feedback. In the remainder of this chapter, first the concept of feedback is described. Next, possible moderating conditions for feedback effectiveness are discussed and supposedly underlying psychological factors are defined, resulting in the main research question. Then, the feedback intervention method ProMES, used throughout the research described in this dissertation, is discussed. Finally, the outline of the dissertation is provided, offering an overview of the different studies that will be presented.

1.1 Feedback

Since the start of the twentieth century, researchers have examined feedback effectiveness (see: Kluger & DeNisi, 1996). Feedback refers to providing employees with information about their performance (Nadler, 1979) and it is a very commonly used intervention tool for the management of the performance of employees (e.g., Ilgen & Moore, 1987). Through stimulation of the effort and persistence of employees, and/or the development and use of effective task strategies, feedback is believed to have a positive effect on performance. According to Nadler (1979), feedback effectiveness can be explained on the basis of Vroom's expectancy model (Vroom, 1964), by making a distinction between (a) the motivational function of feedback, stimulating sheer effort applied to a task; and (b) the cueing and learning function of feedback, stimulating the development and use of task strategies.

This distinction between task-motivation processes and task-learning processes is advocated in the Feedback Intervention Theory (FIT), recently developed by Kluger and DeNisi (1996). In this theory, several prior existing motivation and learning theories containing the concept of feedback were integrated, such as control theory (e.g., Annett, 1969), goal setting theory (e.g., Locke & Latham, 1990), and multiple-cue probability learning (e.g., Balzer, Doherty, & Oconnor, 1989). FIT is based on several assumptions: (a) behavior is regulated by comparing feedback to standards; (b) standards are hierarchically organized, ranging from attention to the self (top level of the hierarchy), through attention to the focal task (moderate level of the hierarchy), to attention to task details (bottom of the hierarchy); (c) only feedback-standard gaps that receive attention are acted upon; (d) attention is usually directed to the focal task; and (e) feedback interventions influence behavior as they change the locus of attention.

According to Kluger & DeNisi (1996), a feedback intervention can have effects on task-motivation processes, as well as task-learning processes. FIT states that with the

intervention, feedback is compared with a standard. Next, effort is increased if the feedback is below the standard, and decreased or maintained if the feedback is above the standard. Working harder is the default reaction of employees, because it requires only the allocation of little additional cognitive resources (Kluger & DeNisi, 1996). However, if sheer effort fails, FIT states that employees will try to work smarter by searching for existing task strategies or developing new task strategies.

1.2 Inconsistent Findings for Feedback Effectiveness

It had long been thought that feedback routinely caused improvements in performance. In a review of early research on this topic, Ammons (1956) stated that feedback unconditionally increases motivational effort and task learning. Kopelman (1982, p. 54) even referred to feedback as an intervention that "virtually always works", because it uniformly energizes and directs task behaviors. However, more recent summarizing research on feedback effectiveness (e.g., Alvero, Bucklin, & Austin, 2001; Balcazar, Hopkins, & Suarez, 1986) has found results to be far from consistent, and several conditions were identified that could play a role in the effect of feedback on performance, such as feedback frequency, feedback source, and feedback form (Balcazar et al., 1986). In a comprehensive meta-analysis, Kluger and DeNisi (1996) even found that feedback interventions had a negative effect on performance in over one third of the studies that were examined. The inconsistencies in these findings strongly suggest that moderating conditions are present for feedback effectiveness, which still need thorough examination.

1.3 Moderating Conditions for Feedback Effectiveness: Task Uncertainty and Types of Feedback

The effectiveness of feedback interventions is believed to be affected by until now underexplored characteristics of the feedback and of the task (Kluger & DeNisi, 1996). In the current dissertation, it is argued that task uncertainty and type of feedback are important moderating conditions for feedback effectiveness.

Task uncertainty is the degree in which tasks are open to chance-based, task relevant influences (Hirst, 1987; Stinson, 2001) and it refers to a lack of specificity of task methods and predictability of (interim) task results (e.g., MacCrimmon & Taylor, 1976). With lower levels of task uncertainty, employees know in great detail which task methods to use and which results may be expected. In other words, they have rather complete knowledge about cause and effect relationships within the task. An example of a certain task would be baking

cookies, where a predetermined recipe can be followed, which is a completely specified method (e.g., adding, mixing). It can also be specified in advance how long it will be before the cookies are ready (e.g., preparation time, baking time) and what the final outcomes will be (e.g., how the cookies will look, how the cookies will taste, and how many will be made). On the other hand, with higher levels of task uncertainty, task methods leading to task results can only be very generally described and employees do not exactly know which results may be expected; their task knowledge with regard to cause and effect relationships is limited. An example of an uncertain task is diagnosing and treating patients after brain injuries, where it is uncertain which treatment method is appropriate for treating the patient, if there exist any at all (e.g., for a patient with a specific cognitive failure in combination with a specific motor aphasia, a new treatment plan might need to be developed). Furthermore, it is unclear what the final results of treatment will be (e.g., will the patient be able to speak again, walk again, and/or live independently).

Given the above described characteristics of task uncertainty, the question arises how to manage the performance of employees with different levels of task uncertainty. The performance of employees in tasks with lower levels of task uncertainty can be managed in a 'classical' way. Here, task processes get little or no attention and performance indicators that serve as the basis for feedback are restricted to outcome variables. Outcome feedback refers to information on the final results of a task delivered to the environment/customer (e.g., Earley, Northcraft, Lee, & Lituchy, 1990; Nadler, 1979), such as quantity or quality of final products, costs, and delivery time. When task uncertainty is low, information on the final results of a task is expected to be sufficient for purposefully adjusting effort and/or task strategies, because employees are very well aware of the cause and effect relationships in the task; in such situations, employees know exactly the behavioral route along which a task can be accomplished. However, it is unlikely that this traditional focus on task outcomes also provides for the necessary conditions when it comes to managing the performance of employees in highly uncertain tasks.

Recent developments in feedback and goal setting theory support our contention that with higher levels of task uncertainty, the focus should be shifted towards task processes instead of task outcomes. Hirst (1981; 1987) has been one of the first to suggest that when task uncertainty is high, a focus on final outcomes with performance management might impede performance because of incomplete knowledge on cause and effect relationships within the task. Here, because of uncertain influencing factors, information on the final outcomes of the task does not provide employees insight in the consequences of their actions,

making it impossible to develop and implement specific, accurately aimed performance improvement strategies. Instead, with higher levels of task uncertainty, it is very likely that the focus of performance management should be shifted towards the work processes (e.g., Molleman & Timmerman, 2003) and employees should be stimulated with each task to generate new behavioral routes to perform the task (e.g., MacCrimmon & Taylor, 1976). Providing feedback on general problem solving process steps could therefore turn out to be a very useful way to enhance employees performance when task uncertainty is high. Process feedback refers to information on the actual task process and interim results (e.g., Earley et al., 1990; Nadler, 1979), such as the degree in which employees consulted co-workers in diagnosing a patient, or to the interim health status of a patient during treatment. In this dissertation, with different levels of task uncertainty, the effects of different types of feedback on performance are examined.

1.4 Underlying Psychological Factors Enhancing Task Knowledge

Performance is expected to be a function of not only motivational efforts, but also of the ability and opportunity to develop and apply task knowledge (e.g., Wall, Cordery, & Clegg, 2002). With higher levels of task uncertainty, task knowledge is far from complete (Hirst, 1987). Under these circumstances, the application of sheer effort is not sufficient (e.g., Earley, Connolly, & Ekegren, 1989) and the development of new task strategies is crucial (e.g., Hirst, 1981). Therefore, psychological factors promoting the development and use of task knowledge are expected to play an important role in feedback effectiveness. However, up to now, these underlying factors have remained underexplored (e.g., Alvero et al., 2001; Pritchard, Harrell, DiazGranados, & Guzman, 2008). Specifically, with higher levels of task uncertainty, through the provision of process feedback, several of such supposedly performance-enhancing factors are expected to be positively influenced: coping with task (un)certainty, task information sharing, role clarity, and empowerment.

In executing an uncertain task, as in any task, employees need to have knowledge about the most appropriate methods to attain optimal task results (e.g., Holmberg, 2006). The ability to link task methods to task results during task execution is what is called coping with task uncertainty. Additionally, employees need to be aware of all task relevant information and need to effectively acquire, share, and process this information (Miranda & Saunders, 2003). Task information sharing can be defined as the degree in which employees have knowledge about the communicational activities necessary to perform a task well (e.g., Janz, Colquitt, & Noe, 1997). Also, to adequately perform a task, employees need to have

knowledge about what the role expectations are, what activities will lead to role fulfillment, and what the consequences of role fulfillment are (Sawyer, 1992). In other words, employees need to have role clarity, defined as "individuals beliefs about the expectations and behaviors associated with their work role" (Hall, 2008, p. 144). Finally, with the execution of an uncertain task, employees need to feel "psychologically enabled", referring to the concept of empowerment (Menon, 2001, p. 161). This means that employees should experience (a) perceived control, referring to employees' beliefs of autonomy in decision making (Menon, 2001); (b) perceived competence, referring to employees' self-efficacy and confidence in role demands (Menon, 2001); and (c) meaning, referring to the fit between the requirements of a work role and employees' behaviors, values, and beliefs (Spreitzer, 1995, 1996). In this dissertation, with different levels of task uncertainty, the effects of different types of feedback on the psychological factors described above are examined.

1.5 Main Research Question

Based on all the previous, the main research question underlying the hypotheses tested in the current dissertation is:

Dependent on the level of task uncertainty, what type of feedback should employees be provided with for feedback to be effective?

1.6 Feedback Intervention Method: ProMES

The feedback intervention method used throughout the research presented in this dissertation is ProMES (Pritchard, 1990). Based on motivation theory (Naylor, Pritchard, & Ilgen, 1980; Pritchard & Ashwood, 2008), ProMES (Productivity Measurement and Enhancement System) incorporates a method to develop and implement feedback on controllable performance indicators that will motivate employees to purposefully apply more effort and/or better task strategies in their work. Through team participation, a bottom-up approach, and discussion until consensus, ProMES performance indicators are developed in two steps: (a) determining main objectives of the employees, in line with the organizational goals; and (b) developing performance indicators for each main objective, satisfying the conditions of measurability, validity, and controllability. After management approval, employees are provided with regular feedback on each performance indicator, and get information on improvement priorities. For more detail, see: Pritchard, Harrell, DiazGranados, & Guzman (2008).

Then, with every feedback report, employees meet as a team to reflect on the feedback during ProMES feedback meetings. Reflection on feedback refers to the degree to which employees, after the receipt of feedback, try to gain knowledge about the causes of increased or decreased performance and develop and later evaluate specific task improvement strategies (Van Tuijl & Kleingeld, 1998). Such reflection is regarded as an important precondition for feedback effectiveness (e.g., Pritchard et al., 2008; Salas, Sims, & Burke, 2005).

1.7 Dissertation Outline

To examine the combined moderating effect of task uncertainty, type of feedback (outcome versus process feedback), and feedback reflection, on feedback effectiveness, three studies have been conducted, each described in one of the next three chapters of this dissertation. Table 1.1 provides an overview of the contents of the remaining chapters, the research method, the research setting, and the study variables. Although the three studies are closely related, the chapters can be read separately.

In the first study (Chapter 2), a meta-analysis is conducted on a database containing almost all ProMES projects ever carried out until recently. Here, 83 field studies from a wide variety of different settings are analyzed to examine the effect of feedback on performance with reflection on feedback, type of feedback, and task uncertainty as possible moderators.

The remaining two studies described in this dissertation are field studies, conducted simultaneously over the course of three years at a medical rehabilitation centre in The Netherlands. Here, patients with mainly physical and/or cognitive disabilities go through treatment programs that help them reintegrate in society. In these three years, complete ProMES systems have been developed and implemented for eight rehabilitation teams with a total of 191 participants.

In the second study (Chapter 3), a task uncertainty framework is defined that serves as the basis for the analysis of the types of ProMES performance indicators that were developed by 50 participants, divided over 8 rehabilitation teams. The selection of these teams was based on the characteristics of their main tasks with regard to the level of task uncertainty. The purpose of this study is to examine whether an interaction exists between the level of task uncertainty and the type of indicator developed as the basis for feedback.

In the third study (Chapter 4), a quasi-field experiment is conducted with 107 participants from the rehabilitation centre. In this study, the combined moderating effect of reflection on feedback, type of feedback, and task uncertainty on the relationship between

Table 1.1

Dissertation outline: Overview of the chapters, research settings, research methods, and study variables.

			Study variables	
Chapter	Research settings	Research methods	Predictor variables	Dependent variables
2	Various, including: - Military - Manufacturing - Service	Meta-analysis	Reflection on feedback Type of feedback Task uncertainty	Effect size (*d*-statistic)

3	Health care (rehabilitation)	Quasi-field experiment	Task uncertainty	Type of indicator
				- Outcome indicators
				- Process indicators:
				  - Problem solving
				  - Procedures
				  - Interim results

4	Health care (rehabilitation)	Quasi-field experiment	Reflection on feedback Type of feedback Task uncertainty	Effect size (*d*-statistic)
		Repeated questionnaires	Type of feedback Task uncertainty	Coping with task uncertainty Task information sharing Role clarity Empowerment: - Perceived control - Perceived competence - Meaning

feedback and performance is examined. After a baseline period, employees first received feedback on task outcomes, after which process feedback was introduced. In addition, over the course of the experiment, each participant was provided with a questionnaire at three different time waves to examine the effect of task uncertainty, outcome feedback and process feedback on underlying psychological enabling factors such as coping with task uncertainty, task information sharing, role clarity, and empowerment.

In the final chapter of this dissertation (Chapter 5), the findings from the three studies are reflected upon. Based on this reflection, implications for theory and practice are discussed, and suggestions for future research are provided.

Chapter 2

Task Uncertainty as a Moderator for Feedback Effectiveness: A Meta-Analysis*

Over the last few decades, researchers have come to realize that feedback does not unconditionally improve performance. In this chapter, the moderating effect of task uncertainty on the effectiveness of a useful feedback intervention, the Productivity Measurement and Enhancement System (ProMES), was examined using meta-analytical methods on 83 field studies. Study variables were the level of task uncertainty, the amount of reflection on feedback, the type of feedback (extent of outcome versus process feedback), and the effectiveness of the intervention on the performance.

For many years, numerous researchers in motivation and in applied areas such as auditing, accounting, and decision making have examined the effect of feedback on the performance of employees. Feedback refers to providing employees with information about their performance (Nadler, 1979) and it is a very commonly used intervention in performance management (e.g., Erez, 1977; Ilgen, Fisher, & Taylor, 1979; Ilgen & Moore, 1987; Kluger & DeNisi, 1996; Nadler, 1979; Pritchard, Jones, Roth, Stuebing, & Ekeberg, 1988). When done

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well, feedback can be effective in facilitating individual and team performance (e.g., Kluger & DeNisi, 1996; Salas, Dickinson, Converse, & Tannenbaum, 1992; Swezey, Meltzer, & Salas, 1994). Authors have argued that it enhances performance by affecting the effort and persistence of employees, as well as in the development and use of appropriate task strategies (e.g., Kluger & DeNisi, 1996; Nadler, 1979; Pritchard et al., 2008).

It had long been accepted that providing employees with information about their performance routinely caused improvements in performance (for reviews see: Ammons, 1956; Kopelman, 1982). However, in the last few decades researchers have found that effects on performance were not consistent (e.g., Alvero et al., 2001; Balcazar et al., 1986; Nadler, 1979). Kluger and DeNisi (1996) found that feedback actually decreased performance in more than one third of the studies they examined. These authors suggested that the effect of feedback on performance is dependent on moderating conditions, namely several feedback and task characteristics, which still need thorough examination.

2.1 Purpose

The goal of this study is to better understand the conditions under which feedback will have a positive influence on performance. To do this, several variables are examined that may moderate this relationship using studies in a wide variety of different settings, where regular feedback was provided using specific measures of performance. The variables examined are task uncertainty, the extent to which employees reflect on the feedback, and whether the feedback is on outcomes or on processes.

The studies to be used in this meta-analysis were done using performance feedback based on the Productivity Measurement and Enhancement System, or ProMES (Pritchard et al., 1988; Pritchard, 1990, 1995; Pritchard, Holling, Lammers, & Clark, 2002). The specifics of this intervention are discussed below, but basically ProMES is a participative system for developing valid and accepted measures of performance and then using them as feedback over time with the goal of improving performance. ProMES has been shown to be an effective way to improve performance (Kleingeld, Van Tuijl, & Algera, 2004; Pritchard, 1990, 1995; Pritchard, Holling, Lammers, & Clark, 2002). A recent meta-analysis (Pritchard et al., 2008) found large performance improvement effects following ProMES feedback with a mean unweighted effect size (*d*) of 1.16 and a weighted mean of 1.44. In line with the findings by Kluger and DeNisi (1996), Pritchard and his colleagues (Pritchard et al., 2008) also found considerable variability in the effects of feedback on performance, suggesting the

presence of moderators. They presented data on a number of these moderators, but suggested that more moderator research was needed. The current study attempts to address this need.

2.2. ProMES

ProMES is a broadly used, participative method to develop performance indicators that serve as the basis for feedback at the individual or team level (Pritchard, 1990). Team participation, together with a bottom up approach and discussion until consensus are the basic principles for the development of ProMES indicators, which implies two steps: (a) determining the main objectives of the employees that are in line with the organizational goals; and (b) for each objective developing performance indicators that are measurable, valid, and largely under the control of the employees. Throughout this process, management approval of the resulting measurement system is obtained. Once the measurement system is approved, employees receive regular feedback on each performance indicator, get an overall performance score, and get information on improvement priorities (for more detail, see: Pritchard et al., 2008). Employees in the work unit meet as a team to review their feedback reports. They discuss how well they did, examine indicator measures that increased and those that decreased with the goal of developing better strategies for doing the work. More details can be found in Pritchard (1990) and Pritchard, et al. (2008).

2.3 Moderators

Reflection on feedback

The first moderator variable to be explored is the extent to which employees actually use the feedback meetings to examine their performance in a way that leads to new ways of doing the work. We call this the degree of reflection on feedback. The logic is that for ProMES feedback to be effective, attempts should be made by employees in the feedback meetings to identify the causes of both increased and decreased performance and to develop and later evaluate specific improvement strategies (Pritchard, 1990; Van Tuijl & Kleingeld, 1998). Past research suggests that reflection positively effects task performance (e.g., De Dreu, 2002, 2007; Frese & Zapf, 1994; Hackman, Brousseau, & Weiss, 1976; Hirokawa, 1990; Moreland & Levine, 1992; Salas et al., 2005; Wong, Tjosvold, & Su, 2007). Based on this logic and the past research, we predict that the better the employees use reflection in the feedback meetings, the greater will be their performance improvement.

Task uncertainty and controllability

The second moderator variable is the level of uncertainty in a task. With very few exceptions (Hirst, 1981; Leung & Trotman, 2005; Rai & Al-Hindi, 2000; Stinson, 2001), most researchers have overlooked task uncertainty and its effect on performance. According to Hirst (1987), task uncertainty is the degree to which tasks are open to chance-based, task relevant influences. Note that interruptions that simply keep one from performing a task without changing its nature do not influence the level of uncertainty of that task, they refer to environmental uncertainty. Additionally, task uncertainty should not be confused with task complexity, which in our view does not refer to the probabilities associated with influencing factors, as with task uncertainty, but rather to the number of factors one should take into consideration when performing a task. Therefore, a task can be very complex, where completion is dependent on a great number of informational cues that should be taken in consideration. However, these cues could still be without any uncertainty (e.g., Hammond, Summers, & Deane, 1973; Leung & Trotman, 2005).

In tasks with low task uncertainty, employees are not hindered by chance-based influences in acquiring task knowledge and in developing appropriate task strategies (Hirst, 1981; MacCrimmon & Taylor, 1976). Algorithms can be used to determine the path to complete the task. An example would be baking cookies, where one can just follow the predetermined recipe (being either simple or complex), which is a completely specified method (e.g., adding, mixing, and cooking). It can also be specified in advance how long it will be before the cookies are ready (e.g., preparation time, baking time, and cooling time) and what the final results will be (e.g., how the cookies will look, how they will taste, and how many will be made).

On the other hand, in tasks with high uncertainty, the results and duration of the task are not known. Even the methods of task accomplishment may be non-specific. Employees will need to engage in problem solving behavior when performing the task: identifying the problem, diagnosing its causes, generating solutions, evaluating solutions, choosing a solution and implementing and revising the selected solution (e.g., Lipshitz & Bar-Ilan, 1996; MacCrimmon & Taylor, 1976). It is uncertain how long this process will take and what the solution (result) will look like. An example would be diagnosing and treating patients after brain injuries. Here, it is uncertain what the diagnosis of the patient will be and which treatment will be appropriate for treating the patient, if there are any at all (e.g., there may not yet be a treatment for a patient with a specific cognitive failure in combination with a specific motor aphasia). Furthermore, the appropriate intensity of treatment is difficult to determine

(e.g., is immediate very intense treatment needed or should treatment intensity be built up over time). It is also uncertain what the results of the treatment will be (e.g., will the patient be able to speak again, be able to walk independently and/or be able to live independently).

In line with the above reasoning, we consider task uncertainty to refer mainly to three elements of a task: (a) the specificity of the steps (behaviors) involved in executing the task, (b) the predictability of task duration (i.e., the time and effort needed to attain the intended result) and (c) the predictability of the task result (i.e., the amount and type of product resulting from executing task behaviors). Our above definition of task uncertainty is intimately related to the notion of controllability of performance measures. The reason is that performance measures may refer to each of the three above task elements. So, when performance measures refer to the final results of a task and these final results are unpredictable, controllability of those performance measures will probably be low. Also, when performance measures have a bearing on task duration and task duration is unpredictable, such performance measures may not be under complete employee control. Performance measures can also be related to the steps (behaviors) involved in a task, the third element in our definition of task uncertainty. However, in this case specificity, not predictability, is the crucial issue and both the steps prescribed by an algorithm and the steps prescribed by a problem solving procedure can be largely under employee control. So, with regard to this element, high task uncertainty does not imply low controllability. For this reason, the concepts of task uncertainty and controllability cannot be considered as more or less equivalent.

Controllability is a critical design requirement for ProMES performance indicators. According to Pritchard (1992), performance measurement for motivational purposes requires filtering out uncontrollable factors and feedback should be limited as much as possible to the controllable elements of a task. Using uncontrollable indicators for feedback can result in an unaccepted, invalid performance management system that will decrease motivation (Algera & Van Tuijl, 1990; Frese & Zapf, 1994; Pritchard, 1990, 1992; Pritchard & Ashwood, 2008; Pritchard, Holling et al., 2002). Only when indicators are controllable can employees use feedback in a constructive way to determine the causes underlying their performance, identify ways to improve performance, and test new improvement strategies by examining its effects on the indicators over time. While on the basis of the above, task uncertainty might be expected to be related to performance improvements following feedback, we argue below that the effects are dependent on the type of feedback.

Task uncertainty and outcome versus process feedback

The third and last moderating variable to be explored in this study is the type of feedback that is provided. Some have made a distinction between two types of feedback, outcome and process feedback (e.g., Earley et al., 1990; Leung & Trotman, 2005; McAfee, Quarstein, & Ardalan, 1995). Outcome feedback refers to the end result of a task process delivered by the employees to the environment/customer. Process feedback refers to the task process to produce an end result: the actual actions of employees, and the interim results produced during task fulfillment.

The distinction between these two types of feedback is important, because process and outcome feedback are not related identically to task uncertainty. We therefore expect that there will be an interaction between type of feedback (outcome versus process), the level of task uncertainty, and the amount of reflection on feedback. We predict that when task uncertainty is low, outcome feedback, that is feedback on the final results of the task, will positively affect performance. The task is characterized by a great amount of predictability and employees know in detail what procedures to follow and what methods to use to attain the desired results. They are strongly aware of the cause and effect relationships within the task and thus can very accurately predict what the results of their actions will be (Hirst, 1981); the connection between their actions and the results is deterministic and strong. Prior to the work activities, decisions about how, when, and what can be produced and specific goals can be formulated for the results that are to be expected (Molleman & Timmerman, 2003). Even when rarer events occur, appropriate task strategies are available and existing rules and algorithms can be used to deal with them (Kleinmuntz, 1985). In this type of task, feedback on the final results of a task, through reflection, will offer sufficient guidance and direction to the efforts of the employees to successfully complete future tasks. Here, employees are able to directly link the final results of their work to their actions, can therefore purposefully adjust their task strategies when results are below expectations, and can subsequently direct their efforts and persistence at attaining the desired result (Stajkovic & Luthans, 2003). This effect will be even greater if degree of reflection is high.

On the other hand, we predict that when task uncertainty is high, feedback on the final results of a task (outcome feedback) will not affect performance. Employees' task knowledge is and remains far less complete with regard to the cause and effect relationships within the task. The presence of unpredictable task relevant influences hinder employees in learning what the consequences of their actions are (Hirst, 1987); the connection between their actions and the results remains weak and based on chance. In these uncertain tasks, feedback on the

final outcomes of a task does not provide employees insight in the consequences of their actions. Reflection on feedback therefore cannot result in specific, accurately aimed improvement strategies. It is possible that providing outcome feedback can produce an increase in the level of sheer effort, but this effort may be misdirected and spent on ineffective actions (Earley et al., 1989; Earley et al., 1990; Kluger & DeNisi, 1996).

Apparently, feedback on a task's outcomes is not expected to be effective in uncertain tasks, because of little to no outcome controllability. Therefore, distinguishing a controllable second type of feedback is useful. According to Balzer, Doherty and O'Connor (1989), feedback should enable employees to compare their present strategy with a representation of an ideal strategy; when task uncertainty is high, only the provision of process feedback will have a positive effect on performance, because the task process is controllable and feedback on this process will help employees focus their attention on the desirable problem solving actions. They thus learn, through reflection, how to cope with the uncertain factors during task completion by constantly developing and adjusting appropriate task strategies to eventually attain suitable results at the end of a task (MacCrimmon & Taylor, 1976). Additionally, we predict that process feedback will also have a positive effect on performance when task uncertainty is low. This type of feedback will help employees focus their attention on the desirable algorithmic actions. Through reflection, scores on process feedback can be directly linked to the results that are to be expected because of the deterministic and strong connection between actions and results. Therefore, task strategies can be specifically adjusted, if necessary, to successfully work towards the final results of a task (Stajkovic & Luthans, 2003).

2.4 Hypotheses

Based on the considerations above, we make the following hypotheses.

> *Hypothesis 1: The greater the reflection in feedback meetings, the larger the improvements in performance.*

While we make the above hypothesis due to the existing literature, based on our discussion of task uncertainty and outcome versus process feedback, we also expect there to be an interaction between reflection on feedback, task uncertainty, and type of feedback.

Hypothesis 2: When task uncertainty is low, employees with more reflection on feedback will outperform employees with less reflection on feedback, irrespective of the type of feedback (outcome or process) they receive.

Hypothesis 3: When task uncertainty is high, employees with more reflection on feedback will outperform employees with less reflection on feedback only when the level of process feedback is high.

2.5 Method

Dataset

This research was conducted using a database that includes all published and unpublished ProMES studies for which data were provided by the researchers. These data were the performance data over time and completion of the ProMES Meta-Analysis Questionnaire (Paquin, 1997, and see: http://promes.cos.ucf.edu/meta.php for a copy of the instrument). This questionnaire attempted to identify variables that might influence the effectiveness of the intervention. It contains items on the characteristics of the organization, description of the developed system, and reactions to the system. Researchers conducting ProMES studies were asked to complete this questionnaire about their study. Approximately 90% of all completed ProMES studies are in this database (Pritchard et al., 2008) and data were available from 88 studies. For an overview of studies included in the database, including information on publication status, the type of organization and target unit, the number of employees in the experimental group, and the amount and frequency of feedback, see Table 2 in Pritchard et al. (2008).

Inclusion Criteria

While the full ProMES database consists of 88 studies, to be included in the analyses here, a study had to have at least three periods of combined baseline and feedback periods. This criterion was necessary to be able to calculate the effect sizes. Five studies from the full database of 88 studies failed to meet this criterion, leaving 83 available studies. However, while all 83 studies had performance data, complete data on the other measures were not provided for all of these studies. Therefore, the number of studies that could be included in the different analyses varied, and depended per analysis on the availability of data on variables of interest.

Other Studies Using the Database

Other published studies have used the ProMES database (e.g., Pritchard et al., 2008; Pritchard, Paquin, DeCuir, McCormick, & Bly, 2002). However, these studies mainly concentrated on the overall effect of the ProMES intervention (e.g., Pritchard et al., 2008; Pritchard, Paquin et al., 2002) or focused on specific issues such as whether feedback lead to enhanced improvement priorities on performance (Watrous, Huffman, & Pritchard, 2006). Although moderators for the relationship between the ProMES intervention and its effectiveness were examined (e.g., interdependence, centralization, quality of feedback), the concepts of task uncertainty, reflection on feedback, and type of feedback were never included in any prior studies. Moreover, all predictor variables used in the current study were newly formed for this research by doing ratings of each study, forming new items through categorization, or using new combinations of existing items from the ProMES database.

Measures

Dependent Variable

The dependent variable was based on specific measures of performance. The measures were different for each study; they were measures specific to that organizational unit. Examples are percent of errors made, percent of orders completed on time, number of clients seen, average time between failures of repaired items, and percent of customers satisfied. ProMES combines the indicator measures into an overall score for a given organizational unit through what are called contingencies. Contingencies are a type of non-linear utility function relating level of the measure to amount of value being added to the organization. This value scale is called the effectiveness score. The contingencies essentially rescale each measure into the same scale, and the resulting effectiveness scores for each indicator can be summed to an overall effectiveness score which represents overall performance for any given feedback period (for more detail, see: Pritchard, 1990 or; Pritchard et al., 2008).

In each ProMES study, a baseline period was followed by a feedback period. During the baseline period, employees did not receive any feedback, and data were collected to determine the employees' performance level prior to the intervention of feedback. During the feedback period, employees received regular feedback about their performance. Most often, the feedback and feedback meetings were once a month, in a few cases it was as short as a week, and in one case as long as a year. The combined number of baseline and feedback periods for these studies ranged from 3 periods to 65 periods, with a mean of 19.84 periods.

The number of baseline periods ranged from 1 to 22, with a mean of 5.23. The number of feedback periods ranged from 1 to 59, with a mean of 14.67.

For each performance period, the indicator data, the corresponding effectiveness scores for each indicator, and the overall effectiveness score were part of the feedback report. These overall effectiveness scores for each work unit over time are the foundation for the dependent variable. The resulting overall effectiveness scores are comparable across time for a given work unit, but not across studies because of the unique set of performance indicators and accompanying contingencies in each study. Therefore, to be able to test for differences in performance between studies, procedures used by Pritchard and his colleagues were followed (Pritchard et al., 2008). An effect size in the form of a *d*-score (Hunter & Schmidt, 2004; Hunter, Schmidt, & Jackson, 1982) for each study was calculated: the increase in mean effectiveness scores from the baseline to the feedback period divided by the pooled standard deviation.

Predictor Variables

The three predictor variables were (a) the type of feedback that was provided in each study: outcome versus process, (b) the amount of reflection on feedback, and (c) the level of task uncertainty.

Feedback type, outcome versus process. To form the type of feedback variable, all ProMES performance indicators in the database were rated as being either an outcome indicator or a process indicator by three independent judges. For the rating, the judges made use of the definitions of these two types of indicators as described before. In rating the indicators in randomized order, the three judges were each provided with the title of the indicator, a short explanation of the indicator, and a very general, short description of the organization where the study was carried out (i.e., location, size, main products). For example, with the indicator "response time", the explanation of the indicator supplied to the judges was "average response time (in hours) to respond to customer call". This indicator belonged to a study carried out in an organization described as "a service division of a computer systems organization, responsible for the maintenance and repair of computer systems that are contracted to the organization by its customers".

After practice ratings using 54 indicators belonging to 7 non-usable studies (due to missing data) the three judges met to discuss their ratings to ascertain uniformity in their thinking about the definitions of outcome and process indicators. Definitions were refined and rules were created in order to standardize the rating process. Next, 779 indicators

belonging to 68 studies were rated independently by each judge on the type of feedback (ICC = .65). According to Klein et al. (2000), values of ICC above .50 are considered adequate and above .70 are considered good. After the rating and the calculation of the interrater agreement, all the indicators where the three judges did not fully agree were discussed among the three judges until full agreement was accomplished. Then, to calculate the type of feedback variable, the number of process indicators for a study was divided by the total number of indicators for that study, resulting in the proportion of process feedback for that study.

Amount of reflection on feedback. To form the reflection on feedback variable, five items were used from the meta-analysis questionnaire, each used a free response scale: "What percentage of feedback reports were followed by a meeting to discuss the feedback report?", "During initial feedback meetings, what percent of the meeting time was characterized by constructive attempts to identify problem causes?", "After experience with feedback meetings, what percent of the meeting time was characterized by constructive attempts to identify problem causes?", "During initial feedback meetings, what percent of the meeting time was characterized by constructive attempts to develop improvement strategies?", and "After experience with feedback meetings, what percent of the meeting time was characterized by constructive attempts to develop improvement strategies?". The composite variable was formed by averaging the responses to the five items. The internal consistency reliability for this five-item scale was $\alpha = .67$.

Task uncertainty. The task uncertainty variable was operationalized by rating the target unit of each study on the level of task uncertainty by three independent judges on a 5-point scale, ranging from *low task uncertainty* (1) to *high task uncertainty* (5). For the rating, the judges made use of the definitions of the different levels of task uncertainty as described earlier. In rating the target units of the randomized studies, the three judges were each provided with a short description of the target unit (i.e., team composition, product/service, production process), the function of the target unit (e.g., military, manufacturing, service), the type of worker in the target unit (e.g., technician, blue-collar, managerial, clerical), a very general and short description of the local organization (i.e., location, size, main products), and the function of the local organization (e.g., military, manufacturing, service). For example, one study was carried out in a target unit, described as "the target unit repairs electronic equipment". The function of the target unit was "military" and the type of worker was "technician". This target unit was part of an organization described as "the air force base supports a group of military air crafts" which had a "military" function.

On the basis of this information, the judges had to form a mental picture of the work of the target unit and subsequently assess the level of task uncertainty. After practice ratings of the target units of 22 non-usable studies (due to missing data), the three judges met to discuss their ratings to ascertain uniformity in their thinking about task uncertainty. Next, the target units of 72 studies were rated independently by each judge on the level of task uncertainty (ICC = .87). The three independent ratings were then averaged to form the task uncertainty variable. Additionally, to ascertain discriminant validity, correlating task uncertainty with task complexity, as measured by Pritchard et al. (2008), revealed a small positive correlation of only $r = .25$ ($p = .04$), supporting the notion of significant conceptual differences between these two constructs.

Control Variables

The Pritchard et al. (2008) meta-analysis found that a number of variables were related to the effect size (*d*-score). The most important of these were used as control variables in the current study. The first was the degree of match, indicating how accurately the ProMES method was applied. It was measured by a single item: "Overall, how closely did the development and implementation of the system in this setting match the process outlined in the 1990 ProMES book?". A 5-point scale was used ranging from *very differently* (1), through *moderately* (3), to *very closely* (5).

The second control variable was the amount of change in the feedback system, indicating to what degree substantial differences had to be made to the ProMES system after the development process. It was measured by five items (α = .54, as assessed by Pritchard et al. (2008)) and example items include "What percentage of the indicators were substantially changed to obtain formal approval?", with free response, and "What degree of changes needed to be made to the original system over the first 6 months of feedback?", with a 5-point scale ranging from *no changes* (1), through *a major change* (3), to *many major changes* (5).

The third control variable was the level of interdependence within the team, indicating to what degree the job required employees to work together. It was measured by a single item: "To what extent did the job require individuals within the group to work with each other?", with a 5-point scale ranging from *very little* (1), through *moderately* (3), to *very much* (5).

The final control variable was the level of centralization, indicating to what degree decision-making and authority are centralized or delegated. It was measured by two items (α = .52, as assessed by Pritchard et al. (2008)) , namely "To what extent was the structure of the

target unit centralized?", and "To what extent was the structure of the local organization centralized?". For both of these items a 5-point scale was used, ranging from *highly decentralized* (1), through *neither* (3), to *highly centralized* (5). Full descriptions of all measurement scales of the variables described above can be found in Pritchard et al. (2008).

Data Analysis

The hypotheses were tested with WLS hierarchical regression analysis, using the 58 studies for which full data were available on all variables of interest. However, inspection of the data revealed that inclusion of the task uncertainty variable would result in a substantially unequal division of the studies into subgroups. Categorization based on the level of task uncertainty, the amount of reflection on feedback, and the proportion of process feedback resulted in subgroup sizes ranging from 1 study to 12 studies within a subgroup. Such an unequal sample size across moderator-based subgroups is expected to severely influence findings, making hierarchical regression analysis unreliable (e.g., Aguinis, 1995; Aiken & West, 1991). Hsu (1993) further showed that the statistical power is fully dependent on the size of the smallest subgroup, regardless of the size of the other subgroups.

In order to prevent the analysis from being influenced by this inequality, the dataset was divided into two subsets, based on a median split of the task uncertainty variable (*Mdn* = 2.33), resulting in a low task uncertainty and a high task uncertainty group. These two subgroups were analyzed separately. As Stone-Romero & Anderson (1994) have pointed out, dichotomization of a continuous variable leads to a more conservative moderator analysis in which Type II error rates are higher, meaning that theoretical models that include moderating effects may erroneously be dismissed. Being able to find a moderator effect of the dichotomized task uncertainty variable through this type of analysis would thus suggest even more robust results (e.g., Cohen & Cohen, 1983; Stone-Romero, Alliger, & Aguinis, 1994).

Then, the hypotheses were tested by examining the differences between the low task uncertainty and the high task uncertainty group with regard to the effects of the amount of reflection on feedback, the proportion of process feedback, and the interaction between these two variables on the *d*-score. For each group, in step one the control variables were entered, in step two the predictor variables were entered, and in step three the interaction was entered in the equation. Additionally, when significant, the simple slopes of an interaction were tested on being different from zero by following a procedure outlined by Aiken and West (1991).

Whenever variables were composed of multiple items with different response scales, scores on these items were standardized before averaging. Also, following the advice of

Aiken and West (1991), all continuous predictor variables were standardized prior to the calculation of the interaction terms.

2. 6 Results

Correlations among Study Variables

Table 2.1 provides the means, standard deviations and correlations for all variables included in this study. Also, the corrected *r* is given in this table, which is the correlation between the *d*-score and the other study variables after correction for unreliability. The reliability of the *d*-score (Rel(*d*) = .84) was estimated through the ratio of variance excluding sampling error to total variance (Hunter & Schmidt, 2004, p. 295). The reliability of the other study variables was estimated by the coefficient alpha of each (reported on the diagonal). When no estimate was available, perfect reliability was assumed.

ProMES Effectiveness

Overall (*k* = 83), the ProMES feedback intervention had a mean effect size (*d*-score) of 1.16 (*SD* = 1.55*)*. The sample-size weighted mean *d*-score (Hunter & Schmidt, 2004) based on the number of data periods for each study was 1.44 (corrected *SD* = 1.44), indicating a substantial effect size where performance during the feedback period on average was 1.44 standard deviations higher than performance during the baseline period. The 95% confidence interval based on this weighted effect size ranged from 1.13 to 1.75. Note that this confidence interval does not cover zero, demonstrating that the positive value of the effect size is reliably different from zero. Additionally, there was a difference in effect sizes for the low and high task uncertainty groups. The mean *d*-scores for low task uncertainty was .84 (*SD* = 1.59, *k* = 36) and for high uncertainty was 1.45 (*SD* = 1.51, *k* = 36). Weighted mean *d*-scores were respectively 1.21 (corrected *SD* = 1.53) and 1.61 (corrected *SD* = 1.37). However, the 95% confidence intervals based on the weighted effect sizes did overlap for these two groups: the low task uncertainty CI was .71 to 1.71, and the high task uncertainty CI was 1.16 to 2.06. An independent-samples *t* test also revealed a non-significant difference between the two groups with regard to the weighted *d*-score (t = -1.17, *p* = .246).

Table 2.1

Means, standard deviations and zero order correlations among study variables.

Variable	*k*	*M*	*SD*	1[a]	1	2	3	4	5	6	7	8
1. *d*-score	83	1.16	1.55	-	-							
2. Degree of match	80	4.48	.75	.48***	.44***	-						
3. Changes in the feedback system	67	.06	.62	-.45*	-.30*	-.48***	(.54)					
4. Interdependence	72	3.49	1.14	-.33**	-.30**	-.36**	-.02	-				
5. Centralization	82	3.26	.69	.39*	.26*	-.05	.24†	-.20†	(.52)			
6. Reflection on feedback	66	.10	.77	.44**	.33**	.37**	-.18	-.14	-.13	(.67)		
7. Proportion process feedback	68	.49	.29	.39***	.36***	.51***	-.52***	-.29*	-.03	-.05	-	
8. Task uncertainty	72	2.35	.91	-.03	-.03	-.09	.07	.09	-.04	-.28*	.17	-

Note. [a]Corrected *r*. Table includes variables from Pritchard et al. (2008).

*** $p \leq .001$. ** $p \leq .01$. * $p \leq .05$. † $p \leq .05$, one tailed.

Hypothesis 1

Hypothesis 1 predicted a positive relationship between the level of reflection on feedback and performance improvement. Table 2.1 shows a correlation between reflection on feedback and the *d*-score of .44 ($p \leq .01$), thus supporting this hypothesis. However, we also predicted an interaction between reflection on feedback, task uncertainty, and type of feedback, so the main effect of reflection on feedback must be considered in the context of the interaction findings.

Hypothesis 2

To test the interaction hypotheses, we used WLS hierarchical regression, with the inverse of the sampling variance used as the weight (Steel & Kammeyer-Mueller, 2002). The analysis using reflection on feedback and proportion of process feedback to predict the *d*-score was done separately for the low task uncertainty studies ($k = 29$) and the high task uncertainty studies ($k = 29$).

Table 2.2 provides the results of this analysis when task uncertainty is low. First, all control variables were entered in the equation, but only centralization ($\beta = .52$; $p < .01$) accounted for variation in the *d*-score ($\Delta R^2 = .30$; $p < .05$, one tailed). Inclusion of reflection on feedback ($\beta = .41$; $p < .05$, one tailed) and proportion of process feedback ($\beta = -.18$; *n.s.*) caused an increase in variance explained ($\Delta R^2 = .13$; $p < .05$, one tailed). However, inclusion of the interaction between reflection on feedback and proportion of process feedback did not improve the prediction of the *d*-score and no additional variance was explained. This interaction is displayed graphically in Figure 2.1. These results indicate that employees doing work with low task uncertainty benefit from reflection on feedback, irrespective of the type of feedback they receive. This is in line with Hypothesis 2.

Table 2.2

Results of the WLS hierarchical regression analysis for low task uncertainty.

	Model 1			*Model 2*			*Model 3*		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Degree of match	.13	.59	.05	.63	.69	.26	.56	.73	.24
Changes in the feedback system	-.41	.50	-.18	-.42	.48	-.18	-.44	.49	-.19
Interdependence	-.06	.27	-.04	-.00	.26	-.00	-.02	.27	-.02
Centralization	.99	.33	.52**	.78	.33	.41*	.76	.34	.40*
Reflection on feedback				.58	.33	.32†	.59	.34	.33†
Proportion process feedback				-.27	.37	-.18	-.29	.38	-.19
Reflection on feedback × Proportion process feedback							.11	.32	.06
R^2			.30			.43			.43
F			2.54†			2.76*			2.29†
ΔR^2			.30†			.13†			.00

Note. $k = 29$.

*** $p \leq .001$. ** $p \leq .01$. * $p \leq .05$. $^{\dagger}p \leq .05$, one tailed.

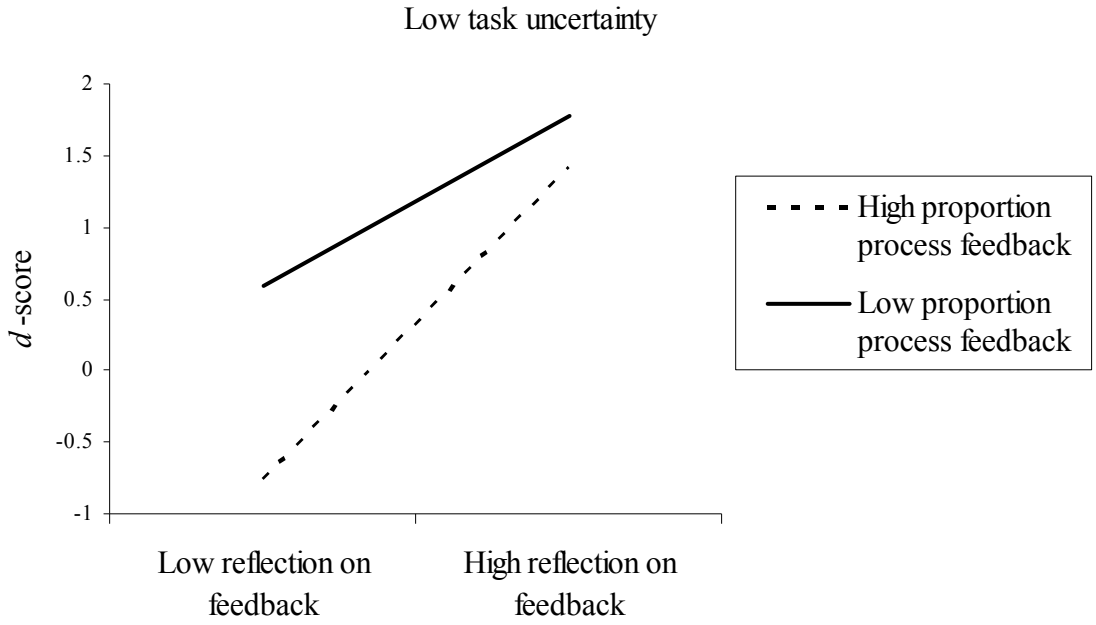

Figure 2.1: Interaction between reflection on feedback and proportion of process feedback when task uncertainty is low

Table 2.3 provides the results of the WLS hierarchical regression analysis when task uncertainty is high. Of all control variables which were entered in the equation, degree of match (β = .46; p < .01) and centralization (β = .53; p < .01) accounted for variation in the *d*-score (ΔR^2 = .48; p < .01). Inclusion of reflection on feedback and proportion of process feedback did not improve the amount of variance explained (ΔR^2 = .04; *n.s.*). However, inclusion of the interaction between reflection on feedback and proportion of process feedback (β = .55; p < .01) did explain additional variance (ΔR^2 = .14; p < .01) in the *d*-score. This interaction is displayed graphically in Figure 2.2.

Table 2.3

Results of the WLS hierarchical regression analysis for high task uncertainty.

	Model 1			*Model 2*			*Model 3*		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Degree of match	.82	.29	.46**	.86	.36	.48*	.35	.36	.19
Changes in the feedback system	-.54	.40	-.21	-.30	.52	-.12	-.89	.49	-.35
Interdependence	-.15	.19	-.12	-.19	.20	-.16	-.35	.18	-.29
Centralization	1.34	.42	.53**	1.23	.53	.49*	.75	.49	.30
Reflection on feedback				-.23	.36	-.13	-.55	.33	-.33
Proportion process feedback				.57	.49	.24	.86	.44	.36
Reflection on feedback × Proportion process feedback							1.40	.48	.55**
R^2			.48			.51			.65
F			5.43**			3.85**			5.59***
ΔR^2			.48**			.04			.14**

Note. $k = 29$.

*** $p \leq .001$. ** $p \leq .01$. * $p \leq .05$.

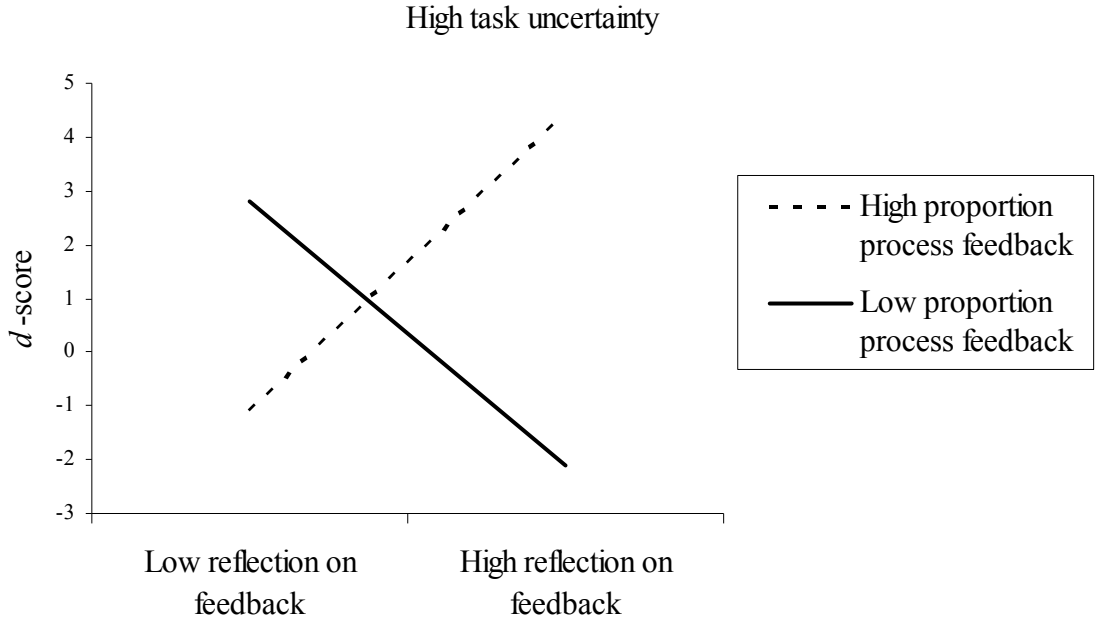

Figure 2.2: Interaction between reflection on feedback and proportion of process feedback when task uncertainty is high

The slopes of both regression lines for the high task uncertainty interaction between reflection on feedback and the proportion of process feedback were tested according to procedures described by Aiken and West (1991). When the proportion of process feedback was high, the simple slope of the regression line had a significant positive value for reflection on feedback (b = 0.85, t = 1.75, $p \leq .05$, one tailed). Employees with a higher proportion of process feedback thus have larger *d*-scores when their reflection on feedback is higher. Furthermore, when the proportion of process feedback was low, the simple slope of the regression line had a significant negative value for reflection on feedback (b = -1.94, t = -2.89, $p \leq .01$). Employees with a lower proportion of process feedback thus have a smaller *d*-score when their reflection on process feedback is higher. These results support Hypothesis 3 and even indicate that when there is a lack of process feedback, reflection on feedback can have a negative effect on performance when task uncertainty is high.

2.7 Discussion

The results of this study help to understand the inconsistency of findings from earlier studies of the effect of feedback interventions on performance. In recent years, the general contention among researchers has been that feedback does not work under all circumstances (see: Alvero

et al., 2001; Balcazar et al., 1986; Kluger & DeNisi, 1996; Nadler, 1979). Our findings suggest that feedback is effective as long as there is reflection on feedback on the right type of performance indicators, depending on the level of task uncertainty. Hirst (1981; 1987) has suggested that task uncertainty, a highly under explored concept, acts as a moderator in the relationship between feedback and performance, where in tasks characterized by high task uncertainty, feedback concerning the end results of the task may not improve performance. The results from the current meta-analysis indeed empirically show that there are substantial interactions between task uncertainty, reflection on feedback, and type of feedback. When task uncertainty is low, employees with more reflection on feedback outperform employees with less reflection on feedback, irrespective of the type of feedback (outcome or process) they receive. On the other hand, when task uncertainty is high, employees with more reflection on feedback outperform employees with less reflection on feedback only when the level of process feedback is high.

Strengths of the effects. To better understand the magnitude of our findings, looking at expected amounts of performance improvement is worthwhile. One *SD* below the mean in feedback reflection is spending *x*% of the feedback meeting time in effective reflection; one *SD* above the mean is *y*% . In the case of low task uncertainty and proportion of process feedback +1 *SD*, the regression equation predicts an effect size for *x*% effective reflection of -.77, while the effect size for *y* is 1.41. With low task uncertainty and proportion of process feedback -1 *SD*, the regression equation predicts an effect size for *x* of .60, and for *y* of 1.78. An effect size of for example 1.78 indicates that the mean overall effectiveness score under feedback is 1.78 standard deviations higher than the overall effectiveness score under baseline. Being 1.78 standard deviations above the mean of a normal distribution means that 96% of the area under the curve is below this value. Therefore, the average monthly performance under feedback equals what was the 96th percentile under baseline, indicating a major effect.

Even larger effects are present in the case of high uncertainty, where the regression equation for proportion of process feedback +1 *SD* predicts an effect size for *x*% effective reflection of -1.12, while the effect size for *y* is 4.39. With high task uncertainty and proportion of process feedback -1 *SD*, the regression equation predicts an effect size for *x* of 2.79, and for *y* of -2.09. An effect size of for example 4.39 indicates that the mean overall effectiveness score under feedback is 4.39 standard deviations higher than the overall effectiveness score under baseline. This indicates that the average monthly performance under feedback equals what was the 99th percentile under baseline.

Implications for Theory

Theoretically, the findings of the current study relate to the Task Group Feedback Effects model proposed by Nadler (1979), which states that the process of using feedback (i.e., reflection on feedback) is a moderator in the relationship between feedback and its effectiveness. Furthermore, the type of feedback determines whether the provision of feedback leads to the application of more sheer effort or to the development of better task strategies. According to this model, particularly process feedback should lead to more effective individual and group task strategies, being problem solving behavior. In line with this model, Kluger and DeNisi (1996) state in their Feedback Intervention Theory (FIT) that if sheer effort (working harder) appears to be insufficient for performance improvement, attention should be directed to task-learning processes (working smarter), in which employees search for task-specific strategies (in tasks that are well-known) or develop new strategies (in task that are not well-known). Process feedback can help with this shift of attention.

The results from the current study indicate that when task uncertainty is low, the proportion of process feedback does not moderate the positive relationship between reflection on feedback and performance. Here, irrespective of the type of feedback they receive, employees with more reflection on feedback outperform employees with less reflection on feedback. Apparently, for these employees, it is crucial to jointly reflect upon their strategies and adapt them to the circumstances if necessary, and they are able to do this wisely on the basis of outcome feedback as well as process feedback. The former seems to be in line with findings by Carter and West (1998), who showed that reflection on team work accounted for a substantial amount of variance in team performance. Furthermore, these same authors stated that reflection would be especially effective for decision-making teams dealing with an uncertain, unpredictable internal and external environment (see also: West, 1996).

In contrast, the results from the current study show that when task uncertainty is high, the proportion of process feedback acts as a moderator: employees with more reflection on feedback outperform employees with less reflection on feedback only when the level of process feedback is high. These employees are thus only able to constructively reflect upon their strategies and adapt them when they are provided with information about their behaviors and/or the accompanying interim results. Moreover, the results suggest a strong negative effect of reflection on feedback when the level of outcome feedback is high, which indicates that providing employees dealing with high task uncertainty with information about the end

results of their work may even detoriate their performance when they try to reflect upon these results. Here, as a result of extensive reflection, employees' efforts are probably misdirected and spent on ineffective, and even hindering actions (e.g., Earley et al., 1989; Earley et al., 1990). This could explain some of the negative effects of feedback on performance found by Kluger and DeNisi (1996), and seems to be in line with findings by Hammond, Summers and Deane (1973), who found in a laboratory experiment that outcome feedback was detrimental to performance in a multiple-cue probabilistic task; a task in which decisions have to be made under highly uncertain circumstances.

Implications for Practice

Currently, there is a shift towards more knowledge-based organizations, requiring employees more and more to be creative and deal with higher levels of uncertainty in their tasks (DeFillippi, Grabher, & Jones, 2007). When developing a performance management system such as ProMES, practitioners in the field should be aware of the level of task uncertainty employees are dealing with in their work, using the definition of task uncertainty described in this study. The type of feedback that is provided should fit this level of task uncertainty when trying to maximize the motivation of employees within organizations. Outcome feedback, traditionally the main focus of feedback interventions (Kluger & DeNisi, 1996), is only useful when there is little task uncertainty and employees are very familiar with the cause and effect relationships within a task. When this is not the case, process feedback should be used, combined with high levels of feedback reflection to identify problem causes and constructively plan and evaluate better work strategies. If outcome feedback is used in tasks of high uncertainty, the opposite recommendation is made, feedback reflection will not be effective and can decrease performance.

Strengths and Limitations

This study has several strengths. First, the ProMES database consists of a large variety of studies, carried out in different countries (e.g., The United States, Australia, Germany, Poland, Sweden, Switzerland, and The Netherlands), in different types of organizations (e.g., manufacturing, services, sales, military, education and health care), with employees ranging from entry level to top management, supporting the generalizability of our findings and the direct link with practice, thereby contributing to the growing literature on evidence-based management (Pfeffer & Sutton, 2006; Rousseau, 2006; Rousseau & McCarthy, 2007; Walshe & Rundall, 2001). Second, approximately 90% of all ProMES studies carried out over the

years were included in the ProMES database. Thus, our findings are representative of almost all ProMES research ever conducted. Finally, the performance measures used in this study are based on specific measures of performance over long periods of time.

There are also several limitations in the present study. In their ProMES meta-analysis Pritchard et al., (2008) noted and addressed a number of limitations such as selection of the work units in which to introduce the intervention, possible Hawthorne effects, potential bias of the person completing the meta-analysis questionnaire, and use of single-item measures. These same limitations apply to this study. The most important limitation of the present study is the statistical power of the analyses because the number of studies in each set of analyses was small. This would lead to greater chances of not finding significant results even though the effects were in the expected direction. For example, even though there was a large difference in the mean effect size between low task uncertainty (mean d = .84) and high task uncertainty studies (mean d = 1.45), this difference was not significant. However, this smaller sample size makes those findings that were significant even more impressive. Another limitation was that not all measurement scales used in the analyses had satisfactory reliability, thereby introducing error variance in the regression analyses. However, because of pre-existence of these scales in the ProMES database and to be able to build on the findings by Pritchard et al. (2008), the original moderating variables found in their overall ProMES meta-analysis were retained in the current study. Next, not all ProMES studies that have been carried out could be included in the hypotheses testing, because of missing data on one or more of the study variables in some studies. Nevertheless, most studies were included and there is no reason to assume that data not included would be systematically different. Finally, in this study, aside from reflection on feedback, the specific mechanisms through which feedback affects performance, as described in the motivation framework by Naylor, Pritchard and Ilgen (1980), and the motivation theory by Pritchard and Ashwood (2008), were not examined.

Future Research

The main findings from this research help explain why the effects of feedback are not always positive and have major implications for how feedback systems should be designed. These findings need to be replicated in future research. Such research should be conducted with other feedback systems in addition to ProMES because this intervention includes a number of other components such as participation, role clarification, and management review. If these findings could be replicated with feedback systems without these additional features, the

findings would be strengthened. Furthermore, future research should address the specific mechanisms through which task uncertainty influences the motivational process. We have argued for a number of mechanisms, but empirical tests of these mechanisms are needed. Finally, future research should more specifically address the effects of process feedback, by breaking this concept down into different types of process indicators, such as process indicators addressing algorithmic actions and process indicators addressing problem solving actions.

Conclusions

This study shows through meta-analysis over a large variety of tasks, teams, organizations, and industries that the effectiveness of feedback on performance is not at all straightforward. The amount of reflection on feedback, the extent of outcome versus process feedback, and the level of task uncertainty play major roles to the extent that some combinations of these variables can lead to very large positive effects and some can actually lead to negative effects on performance. The design of feedback in performance management systems could benefit from taking these finding into account.

Chapter 3

Performance Management in Health Care: Task Uncertainty, ProMES development, and Types of Performance Indicators*

This chapter proposes that with the implementation of performance management systems, the level of task uncertainty influences the perceived usefulness of different types of performance indicators (outcome indicators and process indicators). In this chapter, we report findings from a field study in health care, in which 8 medical rehabilitation teams, varying on their levels of task uncertainty, participated in the development of performance management systems using the ProMES method.

The last few years, the use of performance management systems is a strongly emerging concept in health care (Campbell et al., 2000; Exworthy et al., 2003). In this area, where team work and task uncertainty often play an important role in the treatment of patients (e.g., Franco et al., 2002; Stevenson, Busemeyer, & Naylor, 1990), care-providing organizations such as hospitals and rehabilitation centres are just starting to develop performance indicators for their employees. At the basis of this is the notion that the work motivation of direct care staff is one of the most important predictors of successful patient recovery (Franco et al., 2002; Guercio et al., 2005).

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However, ever since performance enhancement interventions such as feedback provision have been introduced in research to enhance the work motivation of employees, the focus has mainly been on the final results of a task (Earley et al., 1990; Ilgen et al., 1979; Kim, 1984; Tuttle & Stocks, 1998). In line with this, arising performance management systems in health care seem to focus mainly on the final results of treatment (e.g., Begley et al., 2002; Russell, 1998). For numerous years, the general contention has been that providing employees with information about their performance on the final results of their work will increase their performance (for a review, see: Kopelman, 1982). However, more recent reviews on this topic have shown that this traditional approach has not always been effective (e.g., Alvero et al., 2001; Balcazar et al., 1986; Hattie & Timperley, 2007) and that results have been far from consistent. In line with these findings, meta-analytical research by Kluger and DeNisi (1996) indicated the possibility of several moderator conditions through which performance may even deteriorate by the provision of information on the final results of a task. These authors conclude that the effects of classical feedback interventions are moderated by the nature of a task, and that these moderating task properties are still poorly understood.

As a contribution to the understanding of these possible moderators, in the study presented in Chapter 2, it was found through meta-analysis that the effectiveness of a feedback intervention is strongly dependent on the level of task uncertainty. It was concluded that for teams dealing with higher levels of task uncertainty, feedback on the final results of a task deteriorated performance. Only when feedback on task processes was provided could these teams increase their performance. On the other hand, for teams dealing with lower levels of task uncertainty, both information on the final results of a task as well as information on task processes enabled these teams to increase their performance.

The findings from Chapter 2 thus indicate that, when it comes to task uncertainty and the provision of feedback, the type of indicator plays an important role in the effectiveness of feedback. More specifically, these findings show the relevance of the dichotomy of outcome and process indicators in the context of task uncertainty. However, still very little is known about what kind of process information could help with the successful fulfillment of uncertain tasks. This requires a more precise specification of process indicators in tasks varying on task uncertainty. The current study aims to elaborate on this by providing a task uncertainty framework and by empirically examining the specific types of performance indicators developed by teams varying on task uncertainty, using the ProMES method (Pritchard, 1990).

3.1 ProMES

A well-validated method to develop valid performance indicators for the work of teams for motivational purposes is ProMES (Pritchard, 1990), which is based on the motivation theory by Naylor, Pritchard, and Ilgen (1980). ProMES stands for Productivity Measurement and Enhancement System and ever since its introduction almost two decades ago, it has been applied in a very broad range of organizations, including manufacturing, service and health care organizations (Pritchard et al., 2008).

The most important design requirement for performance indicators developed through ProMES is that they are controllable by the team. Pritchard, Holling, Lammers, and Clark (2002) state that using uncontrollable measures results in an unaccepted, invalid performance management system that will deteriorate motivation (see also: Algera & Van Tuijl, 1990; Frese & Zapf, 1994; Pritchard, 1990, 1992; Pritchard & Ashwood, in press). Pritchard (1992) argues that measuring the performance of employees for motivational purposes requires filtering out factors that employees can't control and that feedback should be limited to elements of a task employees can control. The provision of feedback should enable employees to determine the causes underlying their performance, should provide them with indications about how to improve performance, and should enable them to test the effectiveness of any improvement strategy that was implemented. Therefore, each performance indicator developed by using the ProMES method must mainly be under control of the team. Moreover, the criterion of controllability of performance indicators most clearly differentiates a ProMES system from other commonly used performance management systems (e.g., Pritchard & Ashwood, in press; Pritchard, Holling et al., 2002). From this, the assumption follows that teams that closely follow the ProMES method as described by Pritchard (1990) indeed develop controllable performance indicators.

3.2 The Task Uncertainty Framework

Which elements of a task are controllable by employees is strongly dependent on the level of task uncertainty. According to a definition proposed by Hirst (1987), task uncertainty is the degree to which tasks are open to chance-based, task relevant influences (see also: Hartmann, 2005; Stinson, 2001). Note that task interruptions that do not change the nature of the task but simply keep one from performing the task thus do not influence task uncertainty.

Hirst (1981) stated that when tasks are uncertain, employees are hindered in attaining task knowledge and in developing valid task strategies. Consequently, a lack of appropriate

task information exists. Based on task dimensions described by MacCrimmon & Taylor (1976), we consider task uncertainty to refer to five elements of a task: (a) the specificity of the problem diagnosis, (b) the specificity of the task methods, (c) the predictability of the interim results of the task, (d) the predictability of the duration of the task, and (e) the predictability of the result of the task. Lacking one or more of these elements increases task uncertainty. Table 3.1 shows the task uncertainty framework, where three different levels of task uncertainty are distinguished and characterized on the basis of the five task elements described above.

When task uncertainty is low, all five task elements are fully specific and predictable. The initial situation provides a specific problem diagnosis. The steps to complete the task can be determined by using algorithms, in which task method, interim task results, task duration, and task result can be laid down in advance. On the other hand, when task uncertainty is high, all five task elements are ill-defined. One starts with an unknown problem diagnosis. Also, the method is non-specific and often still needs to be developed through problem solving, where employees repetitively need to go through cycles of identifying the problem (phase 1), diagnosing its causes (phase 2), generating solutions (phase 3), evaluating solutions (phase 4), choosing a solution (phase 5) and implementing and revising the selected solution (phase 6) (e.g., Brim, Glass, Lavin, & Goodman, 1962; Lipshitz & Bar-Ilan, 1996; MacCrimmon & Taylor, 1976). Furthermore, the interim results, the duration of the task and the result of the task are uncertain and cannot be determined in advance. For teams dealing with moderate task uncertainty, the five task elements are less than fully specific and predictable, where heuristics are used to come from a rough problem diagnosis to a specific result from a set of alternatives.

Table 3.1

The task uncertainty framework.

Level of task uncertainty	Initial situation	Task strategy	Interim results	Total duration	End result
Low	Specific problem diagnosis	Algorithms (exact procedures)	Exactly known	Exactly known	Exactly known
Moderate	Rough problem diagnosis	Heuristics (if-then rules)	Known as set of alternatives	Known within boundaries	Known as set of alternatives
High	Unknown problem diagnosis	Problem solving (general step-by-step plan)	Unknown	Unknown	Unknown

3.3 Feedback and Types of Performance Indicators

The level of task uncertainty and the controllability of the task elements are of influence on the effectiveness of feedback interventions. Feedback is a broadly applied tool for the management of employees' performance (e.g., Erez, 1977; Ilgen & Moore, 1987; Kluger & DeNisi, 1996; Pritchard et al., 1988), and can be defined as providing employees with information about their task results and/or actions (Nadler, 1979). As described in Chapter 2, feedback can thus be provided on two main types of performance indicators: outcome indicators and process indicators. An outcome indicator refers to the end result of a task process delivered by the employees to the environment/customer, or it refers to the total duration of a task. For example, an outcome indicator could refer to the final physical state of a patient after completion of a rehabilitation treatment program, or to the total duration of treatment completion. On the other hand, a process indicator refers to everything that takes place during the task process to produce an end result: the actual actions of employees during task fulfillment, and the interim results belonging to a task. For example, a process indicator could refer to the degree in which employees collected all relevant task information before deciding on continuation of a rehabilitation treatment program, or to the interim physical state of a patient during treatment.

In turn, derived from the task uncertainty framework, three types of process indicators can be distinguished: problem solving process indicators, procedural process indicators, and interim results process indicators. A problem solving process indicator refers to the problem solving task strategy that employees need to follow to attain a suitable task result. For example, a problem solving process indicator could refer to the degree in which employees carefully evaluated all possible treatment alternatives before deciding on the contents of a patient's treatment program. Next, a procedural process indicator refers to the algorithmic task strategy that employees need to follow to attain a suitable task result. For example, a procedural process indicator could refer to the degree in which employees have provided a patient with all physical activities as described in the general treatment program. Finally, an interim results process indicator refers to the interim results that employees need to produce when executing a task. For example, an interim results process indicator could refer to the interim physical state of a patient during treatment.

3.4 Hypotheses

The task uncertainty framework helps in describing the work of teams in terms of task uncertainty. It can therefore also be used to examine what type of performance indicators are

most likely controllable and thus effective, when the aim is to stimulate teams (through feedback) to pay attention to actions that contribute to the realization of optimal end results. In other words, when one knows which row in the task uncertainty framework is typical for the work of a team, one knows what type of performance indicators are most likely effective for motivational purposes: When task uncertainty is low, information can be provided on interim and end results, which are exactly known in advance, because of a strong connection between the actions and these results (Pritchard & Ashwood, in press). Moreover, information on the accompanying procedures that are to be followed can additionally help in motivating employees to engage in the prior specified, required actions (Kluger & DeNisi, 1996). However, when task uncertainty is high, with interim and end results unknown in advance, which cannot be linked to certain actions after task fulfillment, only information on the optimal problem solving task strategy can help in motivating employees to successfully complete a task.

Consequently, with different levels of task uncertainty, differences in the bottom-up development of controllable performance indicators through ProMES are particularly expected with regard to a focus on the end result (outcomes) versus on the task strategies (processes), and with regard to the type of useful process information. More specifically, based on the task uncertainty framework, the following hypotheses can be defined:

Hypothesis 1: using the ProMES method, teams higher on task uncertainty will develop relatively more process indicators (compared to outcome indicators) than teams lower on task uncertainty.

Hypothesis 2: An interaction exists between task uncertainty and the three types of process indicators, such that...

Hypothesis 2a: ...using the ProMES method, teams higher on task uncertainty will develop relatively more problem solving process indicators (compared to other types of process indicators) than teams lower on task uncertainty.

Hypothesis 2b: ...using the ProMES method, teams higher on task uncertainty will develop relatively less procedural process indicators (compared to other types of process indicators) than teams lower on task uncertainty.

Hypothesis 2c: ...using the ProMES method, teams higher on task uncertainty will develop relatively less interim results process indicators (compared to other types of process indicators) than teams lower on task uncertainty.

3.5 Method

Sample

This study included 50 participants, divided over 8 teams. These teams were all part of a medical rehabilitation centre in The Netherlands, with over 300 employees divided over 22 teams. Here, patients with mainly physical and/or cognitive disabilities follow treatment programs that help them reintegrate in society. The participating teams were selected on the basis of the characteristics of their main tasks with regard to the level of task uncertainty. In the meta-analysis described in Chapter 2, task uncertainty was operationalized by letting a number of assessors make judgments about the degree in which the main elements described in the task uncertainty framework were present in a team task, using general characteristics of the work of a team and its organization. In the current study, task uncertainty was measured in a similar way, by presenting a number of employees who are familiar with the work of a team with questions with regard to the five elements described in the task uncertainty framework, prior to the ProMES development. For this purpose, semi-structured interviews of 60 to 90 minutes were jointly held by 2 interviewers with 2 members from the management team, 3 rehabilitation specialists and 22 employees from several medical disciplines (e.g., physiotherapists, psychologists, nurses). All these persons had a good overall picture of the main tasks of the rehabilitation teams. Each interviewee was provided with the definitions of the different levels of task uncertainty from the task uncertainty framework. Then, on the basis of these definitions, the interviewee was asked to name teams dealing with higher levels of task uncertainty and teams dealing with lower levels of task uncertainty. Next, the interviewee was asked to describe the treatment programs for these teams and to indicate where, during treatment, uncertainty occurs and in what form. The interview scheme that was used is provided in Appendix A.

On the basis of the results of the interviews and written documentation on treatment programs, teams were rated jointly by the 2 interviewers on being either low or high on task uncertainty. Next, eight most contrasting rehabilitation teams were selected, based on their levels of task uncertainty. An example of a team low on task uncertainty is a team for the rehabilitation treatment of patients with heart failures. From a clearly specified diagnosis, one can just follow the predetermined treatment program, which is a completely specified

method, consisting of standard activities (e.g., cycling, walking, informational meetings) with fully known interim results. It can also be specified in advance how long it will take before the patient will be discharged (e.g., duration and frequency of observation, duration and frequency of treatment) and what the results will be (e.g., what the final physical state of the patient will be). An example of a team high on task uncertainty is a team for the rehabilitation treatment of patients with acquired brain injuries. Here, the initial state of the patient is unknown and it is not certain which treatment method will be appropriate, if there exist any at all (e.g., what is the optimal treatment program for a patient with an unfamiliar cognitive injury in combination with a motor aphasia). Also, it is not known in advance what interim results will follow from treatments applied, and the optimal duration and the intensity of treatment are difficult to determine in advance (e.g., should the intensity of a treatment be built up over time or should it be held constant from the start of the program). Also, the final result of the treatment cannot be specified in advance (e.g., what will the abilities of the patient be with regard to speech, cognition and movement at the end of the program).

The finally selected, participating teams were 'hand trauma', 'heart failure', 'amputation', and 'chronic pain' (all four rated as low on task uncertainty), 'children with developmental coordination disorders (DCD)', 'parkinson disease', 'young children (0 to 4 years) with developmental disorders', and 'acquired brain injuries' (all four rated as high on task uncertainty).

ProMES Indicator Development

Each of the eight participating teams then carefully went through the first two steps of the ProMES method, closely following the guidelines described by Pritchard (1990). Team participation, a bottom-up approach, and discussion until consensus are key principles of ProMES and prior to the start of the indicator development, for each rehabilitation team a design team was composed, consisting of one person from each relevant medical discipline and a rehabilitation specialist or supervisor. Additionally, each team was guided by one ProMES facilitator of a total of two facilitators involved in this research. Each of these facilitators was responsible for ProMES development for four teams.

In step 1, the main objectives of the team that are in line with the organizational goals were determined. This step started with brainstorm sessions on the following questions: "What does the team contribute to the overall organization?", and "On which areas of the work should the team perform well?", resulting in an extensive list of main objectives. Next, these objectives were evaluated on the basis of their main ProMES selection criteria, namely

the extent to which each main objective is in line with the organizational goals and the list with main objectives is complete. Eventually, this discussion resulted in a final list of main objectives (i.e., effectiveness, efficiency, expertise, and customer satisfaction).

In step 2, for each main objective, performance indicators were developed. This step started with brainstorm sessions on the following question: "How should one measure how well the team is meeting each main objective?", resulting in an extensive list of performance indicators for each main objective. Next, the performance indicators were evaluated on the basis of their main ProMES selection criteria, namely whether each indicator is (mainly) controllable by the team, each indicator represents the performance on its main objective, each indicator is cost effectively measurable, and the list with indicators is complete for each main objective. Eventually, this discussion resulted in a final list of performance indicators for each main objective (e.g., percentage of treatment goals accomplished at the end of the treatment program, percentage of medical treatment reports completed, mean number of treatment hours).

Finally, at the end of step 2, agreement was sought by the team with the management during a review- and approval meeting. The management was asked to critically review the set of main objectives and the accompanying performance indicators on the basis of the main selection criteria described earlier, including controllability. Eventually, this resulted in a definitive set of main objectives and accompanying performance indicators for each team. A more extensive description of the ProMES method is given by Pritchard (1990) and Pritchard et al. (2002).

Categorization of Performance Indicators: Outcome and Process Indicators

All ProMES performance indicators developed were then rated by two independent judges on being either outcome indicators or process indicators. In rating the randomized indicators, the two judges were each provided with a short description of the ProMES indicator and each judge was aware of the type of organization the ProMES systems were developed for (a rehabilitation centre). In total, 104 performance indicators were rated independently by each judge on the type of indicator (ICC = .90). According to Klein et al. (2000), values of ICC above .50 are considered adequate and above .70 are considered good. After the rating and calculation of the interrater agreement, all the indicators where the two judges did not fully agree were discussed until full agreement was accomplished. Then, the number of process indicators in a ProMES system was divided by the total number of indicators for that ProMES system, resulting in the proportion of process indicators for that ProMES system.

Categorization of Process Indicators: Problem Solving, Procedural, and Interim Results Process Indicators

Next, all process indicators were rated by two independent judges on being either problem solving process indicators, procedural process indicators, or interim results process indicators. In the meta-analysis described in Chapter 2, the type of performance indicator was determined by providing a number of assessors with the total, randomized set of performance indicators of all ProMES projects included in the meta-analysis and letting them make judgments solely about whether each indicator referred to an end result or to the task process. However, in the current study, the type of performance indicator was determined with more precision by making use of the task uncertainty framework; after the ProMES development and the rating of the performance indicators on being either outcome or process indicators, two judges were provided with the randomized set of process indicators developed, and were asked to make judgments about whether each process indicator referred to a problem solving strategy, to a procedural strategy, or to an interim result. In rating the randomized process indicators, the two judges were each provided with a short description of the ProMES indicator and any accompanying process checklists used to measure the actions of employees. Additionally, each judge was aware of the type of organization the ProMES systems were developed for. In total, 67 process indicators were rated independently by each judge on the type of process indicator (ICC = .86). The two judges met half-way in a meeting of 20 minutes to ascertain uniformity in their thinking about the definitions of the different types of process indicators. After the rating and calculation of the interrater agreement, all the indicators where the two judges did not fully agree were discussed until full agreement was accomplished. Then, for each type of process indicator, the number of that type of process indicators in a ProMES system was divided by the total number of process indicators for that ProMES system, resulting in the proportion of each type of process indicator for the process indicators in that ProMES system.

Data Analysis

To test Hypothesis 1, the relation between the level of task uncertainty and the type of indicators was examined through an independent-samples *t* test. To test Hypothesis 2, the interaction between the level of task uncertainty and the three types of process indicators was examined by making use of a between-within ANOVA and post-hoc independent-samples *t* tests. By making use of a between-within analysis, the interdependence between the three

types of process indicators (which sum to 100% total) was taken into account, when testing for an interaction effect.

3.6 Results

After step 1 of the ProMES method, it appeared that all teams developed very similar main objectives: effectiveness, efficiency, expertise, and customer satisfaction, which are very commonly used objectives in performance management systems (see: Pritchard, 1995; Pritchard, Holling et al., 2002). However, after step 2 of the ProMES method, clear differences emerged between the teams with regard to the type of performance indicators developed. In Appendix B, all performance indicators that were developed for the eight rehabilitation teams are provided, including the type of each indicator.

Table 3.2 provides an overview of the types of indicators developed per team, stating the estimated level of task uncertainty, the number of performance indicators, the percentage of process indicators, and the percentages of the three types of process indicators per team.

Outcome versus Process Performance Indicators

An independent-samples *t* test was conducted to evaluate the hypothesis that teams higher on task uncertainty would develop relatively more process indicators (compared to outcome indicators) than teams lower on task uncertainty. The results support Hypothesis 1 ($t(6) = 2.47$, $p = .05$). Teams with a high level of task uncertainty ($M = 80.2$, $SD = 22.9$) on average developed more process indicators than teams with a low level of task uncertainty ($M = 50.1$, $SD = 8.3$). Two teams from the high task uncertainty group even solely developed process indicators. During brainstorm sessions, these teams did bring up several ideas for outcome indicators. However, through discussion until consensus, each of these were eliminated from the initial list of indicators for reasons of little to no controllability. For example, members of the team 'acquired brain injuries' initially came up with indicators regarding for example patients' level of self-reliance and patients' level of walking abilities at the end of the treatment program. However, during ProMES' selection phase these indicators were evaluated as uncontrollable because of patients' unique medical state and uncertain factors such as patients' spontaneous medical recovery, patients' cognitive ability, patients' constructive apraxia, patients' verbal abilities, medical complications, and changes in patients' environment such as housing and family conditions. Members of the team 'young children' initially came up with indicators regarding for example children's developmental progression

Table 3.2

Level of task uncertainty, number of ProMES performance indicators, percentage of process indicators, and percentage of types of process indicators per team.

Team	Level of task uncertainty	Total performance indicators		Process indicators		
		Number of performance indicators	% process indicators	% interim results process indicators	% procedural process indicators	% problem solving process indicators
hand trauma	low	20	45.0	33.3	66.7	0.0
heart failure	low	13	46.2	83.3	16.7	0.0
amputation	low	15	46.7	42.9	57.1	0.0
chronic pain	low	8	62.5	60.0	20.0	20.0
children with DCD	high	12	58.3	42.9	14.2	42.9
parkinson disease	high	8	62.5	60.0	0.0	40.0
young children	high	14	100.0	42.9	7.1	50.0
acquired brain injuries	high	14	100.0	35.7	7.1	57.2

as measured at the end of the treatment program. However, during ProMES' selection phase these indicators were evaluated as uncontrollable because of children's unique medical state and uncertain factors such as children's natural physical and cognitive development, children's cognitive ability, medical complications, children's support from family, and changes in children's environment such as housing and family conditions.

The other two teams from the high task uncertainty group, 'parkinson disease' and 'children with DCD' developed sets of performance indicators with respectively 62.5% and 58.3% process indicators. Both these teams developed several outcome indicators. For 'parkinson disease', these outcome indicators included for example the mean difference scores on patients' satisfaction with the result of the treatment program. For 'children with DCD', these outcome indicators included for example the percentage of patients with a sufficient difference in COPM satisfaction score and the mean score on satisfaction for the result of the treatment. COPM stands for Canadian Occupational Performance Measure (e.g., Verkerk, Wolf, Louwers, Meester-Delver, & Nollet, 2006) and assesses the problems that are encountered in the performance of daily activities by detecting changes in the perception of a patient's performance and satisfaction over time. In general, these outcome indicators were assessed as sufficiently controllable by the teams, because most indicators did not concern the actual result scores on medical tests, but the satisfaction of the patients and/or the team members with these scores instead. By working not only on the physical recovery of patients, but also on the awareness and acceptance of patients with regard to their medical condition, these teams believed they could at least partly influence the level of satisfaction of patients with the final results of their treatment program.

The four teams from the low task uncertainty group, 'chronic pain', 'amputation', 'heart failure', and 'hand trauma', developed sets of performance indicators with respectively 62.5%, 46.7%, 46.2%, and 45.0% process indicators, and thus relatively more outcome indicators. But clearly, although these teams are low on task uncertainty, only approximately half of all indicators developed by these teams were outcome indicators. For 'chronic pain', examples of outcome indicators developed are the percentage of long term treatment goals accomplished at the end of the 12-week treatment program and the percentage of patients with a sufficient increase on SF-36. SF-36 stands for Medical Outcomes Short Form Questionnaire (e.g., Ware, Snow, Kosinski, & Gandek, 1993) and is a patient self-report measure that assesses major health concepts, such as vitality, role function, social function, and mental health. For 'amputation', examples of outcome indicators developed are the mean score on normal activities with prosthesis, the mean score on normal activities without prosthesis and the

mean score on extra activities with prosthesis. For 'hand trauma', examples of controllable outcome indicators developed are the mean level of strength recovery for patients with an injured dominant hand, the percentage of patients with a throughput time larger than 12 weeks, and the mean score on Kapandji. The Kapandji test (e.g., Kapandji, 1987) assesses the level of flexion of the thumb. For 'heart failure', controllable outcome indicators were developed regarding for example the mean number of treatment hours, the percentage of patients with a throughput time smaller than 12 weeks, the percentage of patients with an increase on a quality of life questionnaire and the percentage of patients with an increase on a shuttle walk test. The quality of life questionnaire assesses a patient's level of physical, emotional and social health. The shuttle walk test assesses the maximum distance a patient can walk within a preset amount of time. For these teams, multiple outcome indicators concerned the actual result scores on medical tests and all outcome indicators were believed to be under the main control of the team by closely following the prescribed treatment program. On the basis of the cause of injury and the existing procedures, these teams stated they could very accurately assess at the start of the treatment program which standard treatment program should be followed, how long this would take and what the final results would be.

Problem Solving versus Procedural versus Interim Results Process Indicators

To test for differences in the types of process indicators that were developed by each team, a between-within ANOVA was conducted with the between factor being the level of task uncertainty and the within factor being the type of process indicator. The results indicated a significant effect for the interaction between task uncertainty and type of process indicator, Wilks's $\Lambda = .12$, $F(2, 5) = 18.93$, $p < .001$, multivariate $\eta^2 = .66$. This interaction is plotted in figure 3.1.

Problem solving and procedural process indicators were developed particularly in the form of process checklists. These process checklists served as behavioral observation scales (e.g., Latham, Fay, & Saari, 1979; Latham & Wexley, 1994), through which teams themselves could indicate whether the required task behaviors and/or process steps were executed during task fulfillment. The nature of these process checklists differed, however, depending on the level of task uncertainty.

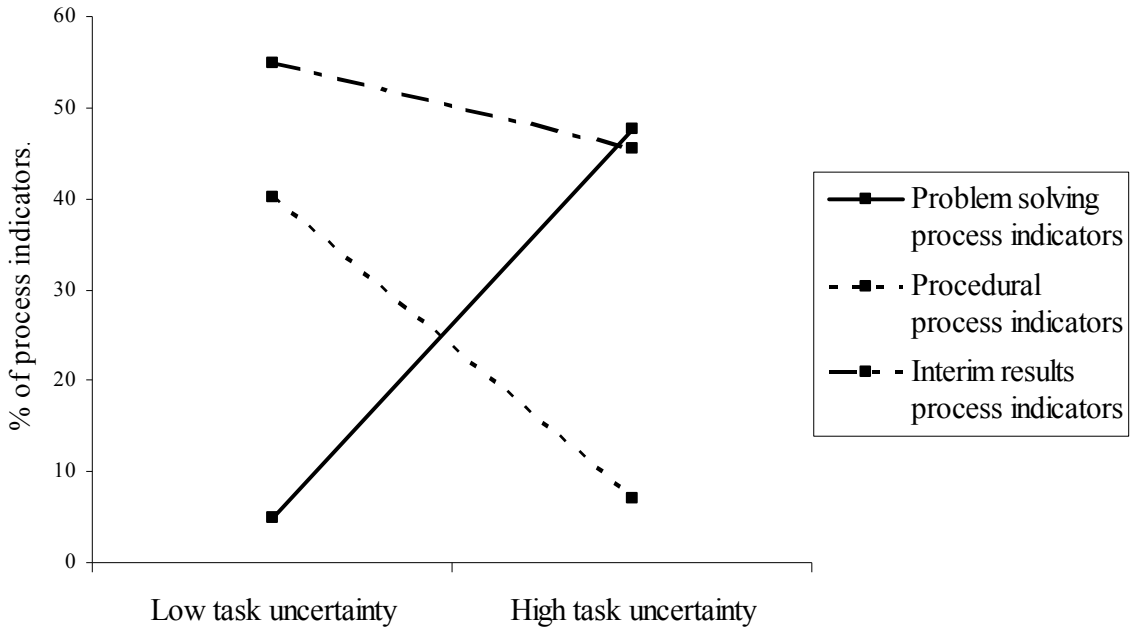

Figure 3.1: Interaction between task uncertainty and type of process indicator

Teams higher on task uncertainty developed more process indicators with a problem solving nature (M = 47.5, SD = 7.7) than teams lower on task uncertainty (M = 5.0, SD = 10.0). An independent-samples t test showed this difference to be significant ($t(6) = -6.74$, p = .001). These findings are in line with Hypothesis 2a. The teams from the high task uncertainty group developed process checklists through which they were mainly stimulated to repetitively engage in problem solving cycles with the treatment of every patient. These teams developed very similar process checklists that helped them in making the correct decisions during the treatment program. To clarify, the checklist developed by the team 'acquired brain injuries' included items regarding for example whether information was provided by all disciplines before each multidisciplinary meeting on a patient's specific request for medical assistance and on a patient's environmental circumstances. This information helped the team in identifying the problem (phase 1 of the problem solving cycle). Additionally, the checklist included items regarding for example whether information was provided on a patient's medical state, on a patient's cognitive ability, and on relevant medical test scores. This information helped the team in diagnosing the problem causes (phase 2). Furthermore, the checklist included items regarding for example whether information was provided on possible treatment goals and on possible treatment strategies.

This information helped the team in generating solutions (phase 3). Also, the checklist included items regarding for example whether possible treatment strategies and possible resource allocations were discussed during a multidisciplinary meeting, which helped the team in evaluating solutions (phase 4). Additionally, the checklist included items regarding for example whether an optimal treatment strategy was formulated and treatment goals were set during a multidisciplinary meeting. This information helped the team in choosing a solution (phase 5). Next, the treatment strategy was implemented and through reflection on reported interim results, the selected solution was revised during consecutive meetings (phase 6). A checklist was to be completed during each multidisciplinary meeting, causing the team to go through multiple consecutive problem solving cycles during the treatment program of a patient.

In contrast, teams higher on task uncertainty developed less process indicators with a procedural nature (M = 7.1, SD = 5.8) than teams lower on task uncertainty (M = 40.1, SD = 25.5). An independent-samples t test showed this difference to be significant ($t(6) = 2.53$, p = .05). These findings are in line with Hypothesis 2b. Teams from the low task uncertainty group developed process checklists through which they were mainly stimulated to follow the prescribed treatment program as precisely as possible. Therefore, the complete program, from start to end, was written down in one checklist, describing all possible treatment steps. To clarify, the checklist developed by the team 'heart failure' included items regarding for example whether a patient did have an intake session with the heart specialist, did participate in each of the physical trainings (e.g., walking, cycling), did have additional individual therapies with the psychologist, did have additional individual therapies with the social therapist, did participate in the anti-smoking session, did participate in the food-and-diet session, and did have an outtake session with the heart specialist. A checklist was to be completed once during the treatment program of each patient, causing the team to have an overview of how carefully a patient went through all the program steps during treatment.

With regard to interim results process indicators: each team included several interim results process indicators and teams higher on task uncertainty (M = 45.4, SD = 10.3) developed slightly less of these indicators then teams lower on task uncertainty (M = 54.9, SD = 21.9). An independent-samples t test showed this difference to be nonsignificant ($t(6) = .78$, p = .46), which does not support Hypothesis 2c. Indicators regarding the timeliness and completeness of medical treatment reports and forms, the timeliness of process steps and the timeliness and completeness of the communication with external care providers were developed by teams from both the high and low task uncertainty groups. Additionally, several

teams from the high task uncertainty group developed interim results process indicators regarding the percentage of interim goals accomplished and interim prognoses realized. Several teams from the low task uncertainty group developed interim results process indicators regarding the correctness of initial choice of treatment program.

3.7 Discussion

The results of the current study indicate that with the implementation of performance management systems, the traditional, widely applied focus on the final results of the work (e.g., Kopelman, 1982) is not justified under all circumstances. In line with findings by for example Alvero et al. (2001), Hattie and Timperley (2007), and Kluger and DeNisi (1996), the effectiveness of feedback on outcome indicators is dependent on moderating conditions. The research described in Chapter 2 shed light on the moderating role of task uncertainty in the effectiveness of performance interventions such as ProMES and with this has shown the usefulness of the distinction between process and outcome performance indicators.

The aim of the current study was to elaborate on these findings by closely examining what kind of information could be regarded as helpful with the successful fulfillment of uncertain tasks, by means of defining a task uncertainty framework and applying this in a field setting through the bottom-up development of performance indicators. Apparently, teams higher on task uncertainty developed performance management systems with relatively more process indicators (compared to outcome indicators) than teams lower on task uncertainty. Our impression is, that with higher levels of task uncertainty, teams do not have sufficient control over the final results of their work because of multiple additional sources of variation. Russell (1998) reasoned that when a care process is not standardized, teams do not have sufficient control over the final results of their work because of multiple uncontrollable sources of variation stemming from the patient, the illness, and the additional care, which are exactly the types of variations found in the current study, as described in the Results section. This lack of controllability limits the possibility to include outcome indicators in a valid performance management system with the intention to increase motivation (Pritchard & Ashwood, in press). This is fully in line with the meta-analytical findings from Chapter 2 with regard to the usefulness of outcome and process feedback with different levels of task uncertainty. Related to this, Russell (1998) stated that if a (care providing) process is not standardized, it is not possible to indicate what actions in the process were the cause of variations in the outcomes, making these outcomes an invalid basis for adaptations of the task

strategies. It is therefore not surprising that Gonzales (2005) found that outcome feedback did not improve performance in an uncertain decision-making task.

The results from Chapter 2 indicated in general that process feedback should be preferred over outcome feedback, since its effectiveness on performance with any level of task uncertainty. However, the current study shows that also the types of process indicators should differ, dependent on the level of task uncertainty employees are dealing with during task fulfillment. Teams higher on task uncertainty developed relatively more problem solving process indicators (compared to other types of process indicators) than teams lower on task uncertainty. Apparently, with higher levels of task uncertainty, teams should be stimulated to repetitively go through problem solving cycles. In line with these findings, MacCrimmon and Taylor (1976) reasoned that when faced with higher levels of task uncertainty, people require strategies for developing new, appropriate task methods. Through the strategy of problem solving, high quality alternatives can be generated and tested, providing a sound basis for decision making. Additionally, Holmberg (2006) stated that when task uncertainty is high, processes that increase the capacity to handle uncertainty, like is the case with problem solving processes, should be encouraged. Alternately, teams higher on task uncertainty developed relatively less procedural process indicators (compared to other types of process indicators) than teams lower on task uncertainty. Apparently, teams lower on task uncertainty should be stimulated to follow the predetermined steps belonging to the task, rather than to try and develop new task methods. These results are consonant with findings by for example Gilson, Mathieu, Shalley, and Ruddy (2005), who found that following standardized work procedures and routines optimized performance under familiar, certain circumstances.

Other than expected, no support was found for the hypothesis that teams higher on task uncertainty would develop relatively less interim results process indicators (compared to other types of process indicators) than teams lower on task uncertainty. Both types of teams developed relatively similar numbers of interim results process indicators (compared to other types of process indicators). However, these findings could very well be explained by the nature of the interim results process indicators developed. Included in interim results were not only the interim medical state of the patient, but all kinds of interim results of direct and indirect, relevant task processes found with any level of task uncertainty. For example, it appears that teams with all levels of task uncertainty needed information regarding the timeliness and completeness of medical and communicational treatment reports. Additionally, teams low on task uncertainty developed interim results process indicators regarding for example the correctness of initial choice of treatment program. This offered

these teams an indication of how accurately standard in- and exclusion criteria for treatment were applied. Furthermore, teams high on task uncertainty developed interim results process indicators regarding for example the percentage of interim goals and prognoses realized. The latter seems to be in line with findings by for example Seijts and Latham (2001), who found that proximal goals had an (indirect) effect on task performance through the discovery and implementation of task strategies.

Theoretical Implications

The current study makes a unique contribution to the existing literature by providing a task uncertainty framework, through which tasks can be characterized on the basis of five different task elements to assess the level of task uncertainty. Moreover, this study elaborates on the moderating role of task uncertainty in the development of valid performance management interventions in a field setting. It appears that employees in practice consider different types of performance indicators to be useful, i.e., outcome indicators and problem solving or procedural process indicators, dependent on the level of task uncertainty. Up to now, none of the previous empirical researches known to us has examined these effects of task uncertainty. Additionally, this study contributes to the vastly growing literature on performance management in health care (e.g., Begley et al., 2002; Campbell et al., 2000; Exworthy et al., 2003; Franks et al., 2006; Lambert, Harmon, Slade, Whipple, & Hawkins, 2005; Russell, 1998; Sapyta, Riemer, & Bickman, 2005), thereby indicating the care and precision that should be taken into account when developing performance indicators for teams in this work area.

Practical Implications

For practitioners in the field of health care, where task uncertainty is often an important characteristic of the treatment of patients (Franco et al., 2002), the use of the different types of process indicators should be enabled, when attempting to increase employees' motivation. Existing treatment programs and general treatment guidelines could be of great help in determining actions relevant for successful task fulfillment. Also, the emerging tendency of managers in health care to solely evaluate the performance of their staff mainly on the final results of treatment (Begley et al., 2002; Russell, 1998), for instance final scores on medical tests and total duration of treatment programs, should be discouraged; evaluations should be made dependent on the level of task uncertainty medical teams are dealing with in their daily work. By making use of the task uncertainty framework, the effectiveness of performance

indicators in feedback interventions on work motivation and consequently on the success of patient recovery can thus be ensured.

Strengths and Limitations

The current study has several strengths. First, the research described in this paper was conducted using a sample of field practitioners, supporting the validity and generalizability of our findings. Second, this is the first study we know of in which the ProMES method was employed in a rehabilitation setting, thereby uniquely contributing to research on performance management in health care. Third, all teams that participated in this study were at a very similar level of development as specialistic teams (SRCB, 2004), preventing differences in the levels of training of the different teams. According to earlier research by Latham and his colleagues (e.g., Latham & Brown, 2006; Latham & Seijts, 1999; Seijts & Latham, 2001, 2005; Winters & Latham, 1996), when people are still in training, learning goals (goals regarding the acquirement of knowledge and skills) should be set. Here, through goal setting and/or feedback provision on process indicators, employees attention needs to be directed towards the development of appropriate task strategies to enable them to learn how to perform their tasks. Fourth, the well-validated ProMES guidelines (see: Pritchard, Harrell, DiazGranados, & Guzman, in press), as described by Pritchard (1990), were accurately followed, thereby ensuring the soundness of our findings. With this, the performance indicators were developed by professionals from the field using a bottom-up approach, thereby ensuring the validity of the indicators developed.

Several limitations of the present study may be noted as well. First, the context of the research is somewhat limited. All teams that participated in this study were part of the same organization, possibly harming the generalizability of our findings. However, by conducting our research in one single organization, variance on non-relevant factors that could have caused non-accountable differences in the eight ProMES systems was reduced, retaining the variance induced by the different levels of task uncertainty. Second, the number of teams that participated in this study is somewhat limited. However, the development of ProMES performance indicators is a very precise and time-consuming job, in which indicators are developed by a team through discussion until consensus, and where each indicator should fulfill all ProMES selection criteria. Moreover, the current study is one of the few studies known to us in which multiple, unique ProMES systems were developed for more than one team within one organization. Finally, the eight ProMES systems were developed with the help of only two facilitators, possibly creating interdependence between the sets of

performance indicators. However, each facilitator was involved in the development of four ProMES systems: two systems for teams low on task uncertainty and two systems for teams high on task uncertainty, preventing the results from being biased by one single facilitator.

Future Research

Future research should seek for validation of the task uncertainty framework by means of for example job analyses, interviews and questionnaires, to support the notion of the five task elements determining the levels of task uncertainty. Moreover, future research could search for additional instruments (e.g., questionnaire scales), aside from the interview technique applied in the current study, that enable a fairly quick and valid method to assess the level of uncertainty in a task. In addition, future research could provide insight in how to efficiently and cost effectively develop, implement, and manage different performance management systems for different teams within one organization, without harming the validity of the different systems and the accompanying performance indicators. Also, future research could address the effects of outcome feedback and the different types of process feedback on the performance of teams varying on task uncertainty. This could provide further support for the validity of our findings with regard to the types of performance indicators thought to be useful for the motivation of teams dealing with different levels of task uncertainty.

Conclusions

This study shows through empirical field research in health care that the level of uncertainty employees are dealing with during care provision determines which types of indicators are regarded as helpful with the successful fulfillment of their tasks. With this, controllability is one of the most important design requirements for the development of valid performance indicators through which employees can be motivated to engage in the required actions in a patient's treatment process.

Chapter 4

The Effectiveness of Different Types of Feedback in Health Care: An Intervention and Questionnaire Study*

In this chapter, the effectiveness of a feedback intervention, by means of the Productivity Measurement and Enhancement System (ProMES), was examined through a quasi-field experiment in health care. With participation of 107 care providers, the combined effect of reflection on feedback, type of feedback (outcome versus process feedback), and task uncertainty on performance was examined. In addition, the combined effect of task uncertainty and type of feedback on psychological factors such as coping with task uncertainty, task information sharing, role clarity, and empowerment was examined.

Health care organizations all over the world more and more need to adjust to free-market conditions (Begley et al., 2002; Van Herk, Klazinga, Schepers, & Casparie, 2001). Therefore, these organizations (e.g., hospitals, medical rehabilitation centres) are facing the challenge of specifically defining their quality and performance (McSweeney, 1997; Russell, 1998). So, it is not surprising that performance management systems are strongly emerging in health care (Campbell et al., 2000; Exworthy et al., 2003). However, the focus of many of these

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management interventions has been on the final results of the medical process, such as clinical effectiveness and total duration of treatment (Begley et al., 2002; McSweeney, 1997; Russell, 1998).

Past research has suggested that this focus on outcomes can have a negative effect on performance. In the meta-analysis described in Chapter 2, it was found that providing employees with information on the final results of their work (outcome feedback) had a negative effect on employees' performance in highly uncertain tasks. These results indicated that in this type of task, employee performance only increased when employees were provided with information on the task process (process feedback). Additionally, reflection on feedback appeared to play an important role in feedback effectiveness. Meta-analytical research by Kluger and DeNisi (1996) already indicated that specific feedback and task characteristics could act as moderators in the effectiveness of feedback on performance, and that additional research is needed to examine these poorly understood moderating conditions.

4.1 Research Purpose

The purpose of the current research is to examine the effectiveness of a feedback intervention method, ProMES (Pritchard, 1990), in a field experiment in health care, using customized performance indicators developed in the study described in Chapter 3. More specifically, the aim of the current study is twofold: Firstly, the aim is to examine the combined moderating effect of reflection on feedback, type of feedback, and task uncertainty on the effectiveness of the feedback intervention. With this, we are empirically testing the theory developed in Chapter 2 and Chapter 3 by making use of a unique quasi-experimental research design, in which we separately test the effects of outcome and process feedback on performance. This research design ensures this research to make a unique contribution to existing literature. Secondly, the aim of this study is to evaluate whether employees dealing with higher levels of task uncertainty benefit from process feedback (as opposed to outcome feedback) with regard to psychological constructs such as coping with task uncertainty, task information sharing, role clarity, and empowerment. Up to now, no studies known to us have empirically examined the effects of different types of feedback on these supposedly performance-enhancing factors for different levels of task uncertainty.

4.2 ProMES

ProMES (Productivity Measurement and Enhancement System) is a feedback intervention method, based on motivation theory (Naylor et al., 1980; Pritchard & Ashwood, 2008). It is designed to enable provision of feedback that is valid and accepted, and will motivate employees to apply more effort and/or better work strategies in their tasks (Pritchard, 1990). Through team participation, a bottom-up approach, and discussion until consensus, the development of the feedback intervention follows four steps. First, the employees' main objectives are determined, in line with the organizational goals. Next, measurable, valid performance-indicators are developed that are under the main control of the employees. Then, priorities within the set of performance indicators are specified by the development of contingencies, so that scores on indicators can be converted into effectiveness scores, which for all indicators can then be combined into an overall effectiveness score. Finally, decisions are made on the frequency and form of feedback provision. Throughout this process, agreement is sought with the management by the team. After approval, employees are provided with feedback on a regular basis on each performance indicator and meet as a team to reflect upon this feedback. A more extensive description of ProMES is given by Pritchard (1990; 1995).

4.3 Moderating Conditions for Feedback Effectiveness

Prior research has suggested that the effectiveness of feedback interventions such as ProMES might be influenced by until now underexplored specific characteristics of the feedback that is provided and/or by specific characteristics of the task at hand (for a review, see: Kluger & DeNisi, 1996). The meta-analysis described in Chapter 2 suggests that feedback reflection, feedback type, and task uncertainty are important moderating conditions with a combined effect on the relationship between feedback and performance.

Reflection on feedback

Reflection on feedback is defined as the degree to which employees, after the receipt of feedback on performance indicators, try to identify the causes of increased or decreased performance and develop and later evaluate specific task improvement strategies (Van Tuijl & Kleingeld, 1998). In the ProMES method, this reflection is enabled through feedback meetings (Pritchard, 1990).

For feedback to be effective, it is crucial for employees to attempt to identify the causes of changes in their performance level and to develop and later evaluate specific

improvement strategies and applied efforts (Van Tuijl & Kleingeld, 1998). Earlier research has shown such reflection to positively affect task performance (e.g., De Dreu, 2002, 2007; Frese & Zapf, 1994; Hackman et al., 1976; Moreland & Levine, 1992; Salas et al., 2005; Wong et al., 2007), and it is expected that the provision of feedback can only have a positive effect on performance when it is sufficiently reflected upon; with lower levels of reflection, the introduction of feedback unconditionally will have no effect on performance.

Type of feedback

In turn, the positive effect of reflection on feedback is expected to be affected by the type of feedback that is provided (outcome versus process feedback) and the level of task uncertainty employees are dealing with during task fulfillment. Reflection on feedback can only result in effective improvements of efforts and/or task strategies, when feedback is provided on the right types of indicators, depending on the level of task uncertainty.

Two main types of performance indicators can be defined that can serve as the basis for feedback (e.g., Earley et al., 1990; Kohli & Jaworski, 1994; Leung & Trotman, 2005): (a) outcome feedback, which refers to the final result of a task delivered to the environment/customer; and (b) process feedback, which refers to the actual task process and its interim results. To illustrate, in the task of treating a patient, outcome feedback could refer to the final health status of a patient after treatment, or to the total duration of treatment. Alternately, process feedback could refer to the degree in which medical staff took all test results into consideration in diagnosing a patient, or to the interim health status of a patient during treatment.

Task uncertainty

In health care, uncertainty can play a significant role in the treatment of patients (Franco et al., 2002; Stevenson et al., 1990). Task uncertainty is the degree to which tasks are open to chance-based, task relevant influences (Hirst, 1987; Stinson, 2001). According to the task uncertainty framework defined in Chapter 3, task uncertainty refers to the specificity of problem diagnosis, the specificity of task methods, the predictability of interim task results, the predictability of task duration, and the predictability of task results. The level of task uncertainty increases as one or more of these task elements are lacking to a greater extent. In health care, the treatment of some patients is characterized by lower levels of task uncertainty with routine treatment procedures, while for others it is characterized by higher levels of task uncertainty where more non-routine treatment methods need to be applied (e.g., Franco et al.,

2002; Holmberg, 2006; Stevenson et al., 1990). With lower levels of task uncertainty, for example in the medical rehabilitation treatment of patients with heart failures, a task is fairly predictable and care providing employees know in detail which treatment methods to use to improve a patient's health status. On the other hand, with higher levels of task uncertainty, for example in the medical rehabilitation treatment of patients with acquired brain injuries, a task is fairly unpredictable and care providing employees have far less knowledge about which treatment methods lead to a patient's health improvement. Here, uncontrollable factors stemming from the patient, the illness, and/or the additional care hinder these employees in learning the cause and effect relationships within the task (Russell, 1998).

As pointed out in Chapter 2, reflection on outcome feedback will only positively affect performance with lower levels of task uncertainty. Here, employees can clearly link the treatment outcomes of their work to their actions (Holmberg, 2006) and can therefore purposefully adjust their efforts and treatment strategies when results are below expectations. Additionally, reflection on process feedback will also have a positive effect on performance, since this type of feedback will help employees focus their attention on the required procedural actions in treatment. Through reflection, efforts can be increased and specifically directed towards treatment strategies on the basis of the well-known cause and effect relationships within the task (Stajkovic & Luthans, 2003). We thus predict that with lower levels of task uncertainty and higher levels of reflection on feedback, the effectiveness of outcome feedback will not be different from the effectiveness of process feedback.

However, with higher levels of task uncertainty, employees do not have sufficient insight in the cause and effect relationships within a task (Hirst, 1981, 1987; Stinson, 2001). Reflection on outcome feedback therefore cannot result in accurately aimed performance improvement strategies, and efforts may be spent on ineffective actions (Earley et al., 1989; Earley et al., 1990; Kluger & DeNisi, 1996). Therefore, we predict that with higher levels of reflection, the introduction of outcome feedback will have no effect on performance with higher levels of task uncertainty. On the other hand, we predict that the introduction of process feedback will have a positive effect on performance. With higher levels of task uncertainty, reflection on process feedback will help employees focus their attention on the required problem solving actions in treatment (Holmberg, 2006). Here, through reflection, treatment strategies can be developed, tested, and adjusted to attain optimal treatment results (MacCrimmon & Taylor, 1976), and in line with the findings from Chapter 2, performance is expected to increase. We thus predict that with higher levels of task uncertainty and higher

levels of reflection, the effectiveness of process feedback will outperform the effectiveness of outcome feedback.

These considerations on reflection on feedback, type of feedback, and task uncertainty lead to the following hypothesis.

> *Hypothesis 1: A three-way interaction exists between reflection on feedback, type of feedback, and task uncertainty, such that only with higher levels of reflection and higher levels of task uncertainty, the effectiveness of outcome feedback will be lower than the effectiveness of process feedback.*

4.4 Underlying Psychological Factors

Wall, Cordery, and Clegg (2002) state that performance is a function of not only the motivation of employees, but also the ability and opportunity to develop and apply task knowledge (see also: Blumberg & Pringle, 1982). Especially under higher levels of task uncertainty, where the development of new treatment strategies is crucial (Hirst, 1981, 1987; MacCrimmon & Taylor, 1976; Stinson, 2001), and the application of sheer effort is not sufficient (Earley et al., 1989; Earley et al., 1990), psychological mechanisms promoting the use and development of knowledge are expected to play an important role in feedback effectiveness (e.g., Holmberg, 2006; Wall et al., 2002). However, until now, these mechanisms have remained underexplored (Kluger & DeNisi, 1996; Pritchard et al., 2008).

With the provision of feedback, several underlying psychological factors are expected to be influenced, depending on the level of task uncertainty and the type of feedback that is provided: coping with task uncertainty, task information sharing, role clarity, and empowerment. All these factors are believed to incorporate the development and use of task knowledge (e.g., Hall, 2008; Janz et al., 1997).

Coping with task uncertainty

When performing a task, employees need to have knowledge about the most appropriate treatment methods to attain optimal treatment results (Edwards & Weary, 1998; Hirst, 1987; Holmberg, 2006). In line with the task uncertainty framework described in Chapter 3, coping with task uncertainty can be defined as the ability to link task methods to task results during task execution. Performance can be enhanced through the development and application of such cause and effect knowledge. Pritchard and Ashwood (2008) state that when the perceived strength of the connection between actions and results is low, employees

experience little control over the final results of their work and in turn, their performance suffers.

When the work is characterized by lower levels of task uncertainty, employees are aware of the cause and effect relationships within a task. Thereby, they know in detail from existing procedures which treatment methods to use to produce adequate treatment results (Hirst, 1987; Stinson, 2001). We therefore expect that their ability to cope with the (un)certainties in the task will already be high, and the introduction of (outcome or process) feedback will not change this.

However, when the work is characterized by higher levels of task uncertainty, cause and effect relationships within the task are far less known (Hirst, 1981; Holmberg, 2006; Stinson, 2001; Wall et al., 2002). Here, the provision of outcome feedback will not clarify to employees the appropriate treatment methods to produce adequate results. Only the introduction of process feedback will help them in coping with task uncertainty, by stimulation of the required problem solving methods to attain the optimal treatment results (Earley et al., 1990; Holmberg, 2006; MacCrimmon & Taylor, 1976; Wall et al., 2002). We therefore define the following hypothesis:

> *Hypothesis 2: With higher levels of task uncertainty (as opposed to lower levels of task uncertainty), the introduction of process feedback (as opposed to outcome feedback) will have a positive effect on coping with task uncertainty.*

Task information sharing

To successfully perform a task, employees need to be aware of all task relevant information and need to effectively acquire, share, and process this information (Miranda & Saunders, 2003). In line with Janz, Colquitt, and Noe (1997), task information sharing is defined as the degree in which employees know the communicational activities necessary to perform a task well, and although prior empirical research is limited, it is believed to be positively related to task performance (e.g., Devine, 1999; Janz et al., 1997).

With lower levels of task uncertainty, employees know in detail what the required communicational activities in treatment are, for which communication protocols most likely exist (Schoonhoven, 1981). We therefore expect that task information sharing will already be high, and the introduction of (outcome or process) feedback will not change this knowledge of task information sharing requirements.

However, with higher levels of task uncertainty, employees knowledge about the communicational activities for optimal task execution is far less complete, and they are unable to link these activities to treatment outcomes. The introduction of outcome feedback will therefore not increase the level of task information sharing (Wagner, Leana, Locke, & Schweiger, 1997; Wall et al., 2002). Only process feedback can help these employees with task information sharing, by including communicational activities in the set of performance indicators on which feedback is provided. We therefore define the following hypothesis:

> *Hypothesis 3: With higher levels of task uncertainty (as opposed to lower levels of task uncertainty), the introduction of process feedback (as opposed to outcome feedback) will have a positive effect on task information sharing.*

Role clarity

To adequately perform a task, employees need to know what the role expectations are, what activities will lead to role fulfillment, and what the consequences of role fulfillment are (Sawyer, 1992). In other words, employees need to have role clarity, which refers to "individuals beliefs about the expectations and behaviors associated with their work role" (Hall, 2008, p. 144; see also: Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964). Role clarity has been positively linked to performance management interventions and actual performance (Pritchard, Paquin et al., 2002). Hall (2008) found that role clarity was positively related to comprehensive performance management systems and managerial performance. Additionally, Bray and Brawley (2002) and Mukherjee and Malhotra (2006) found role clarity to be positively related to task performance.

With lower levels of task uncertainty, employees precisely know what their role is, that is what the requirements are with regard to the expectations and (procedural) behaviors in the treatment of patients (Hirst, 1987; Kohli & Jaworski, 1994; Stinson, 2001; Wall et al., 2002). We therefore expect that role clarity will already be high, and that the introduction of (outcome or process) feedback will not change this.

However, with higher levels of task uncertainty, ambiguity is an important part of the task (Molleman & Timmerman, 2003), and role clarity is low. Outcome feedback will not provide employees working under higher levels of task uncertainty with information about the expectations and relevant behaviors for the treatment of these patients (MacCrimmon & Taylor, 1976; Wall et al., 2002) and role clarity will remain low. Only process feedback will increase role clarity, by providing insight in the relevant (problem solving) behaviors and the

accompanying expectations for treatment (Hall, 2008; Kahn et al., 1964; Kohli & Jaworski, 1994; Sawyer, 1992), through which employees' sense of control eventually could be increased (e.g., Bliese & Castro, 2000; Lang, Thomas, Bliese, & Adler, 2007). We therefore define the following hypothesis:

> *Hypothesis 4: With higher levels of task uncertainty (as opposed to lower levels of task uncertainty), the introduction of process feedback (as opposed to outcome feedback) will have a positive effect on role clarity.*

Empowerment

Empowerment refers to "being psychologically enabled" (Menon, 2001, p. 161), and consists of three distinct dimensions: (a) perceived control, referring to beliefs of autonomy in the work, (b) perceived competence, referring to self-efficacy and confidence in role demands, and (c) goal internalization, referring to the enabling power of ideas, such as an organization's mission or goals (Menon, 2001). Different from Menon's goal internalization, Spreitzer (1995; 1996) defined meaning as a third dimension of empowerment, referring to the value of work goals, judged in relation to an individual's ideals. Compared to Menon's goal internalization, Spreitzer's concept of meaning better connects with the fit between the requirements of a work role and behaviors, values, and beliefs, relevant for the current study. Just as role clarity, empowerment has been positively linked to performance management interventions and performance (Hall, 2008), through the more effective development and application of task knowledge (Wall et al., 2002).

With lower levels of task uncertainty, employees do not need much authority to make decisions during the treatment process, since most decisions have been made centrally (Schoonhoven, 1981; Wall, Corbett, Martin, Clegg, & Jackson, 1990), and laid down in procedures and algorithms. Therefore, employees will perceive little autonomy (Wall et al., 2002). At the same time, because of the extensive knowledge of cause and effect relationships within the task with lower levels of task uncertainty (Hirst, 1987; Stinson, 2001), employees will already perceive their competence to be high. Additionally, their level of meaning will already be high, because they can fairly easily link their actions to the treatment's requirements (Wall et al., 2002). We thus expect that with lower levels of task uncertainty, the introduction of (outcome or process) feedback will not change perceived control, perceived competence, and meaning.

However, with higher levels of task uncertainty, employees should be given the authority to make decisions on "what", "how", and "when" during treatment (Holmberg, 2006; Molleman & Timmerman, 2003; Proenca, 2007; Wall et al., 1990; Wall et al., 2002), and decision-making should be decentralized (Schoonhoven, 1981). Here, the introduction of outcome feedback does not fill this need, because information on outcomes does not give these employees the opportunity to purposefully adjust their task strategies, and perceived control will remain low (Edwards & Weary, 1998). Only process feedback can help these employees to autonomously improve their task strategies through problem solving (Holmberg, 2006), increasing their level of perceived control (Wall et al., 2002).

With respect to the perceived competence component of empowerment, with higher levels of task uncertainty, the lack of knowledge of cause and effect relationships will make employees feel less competent in their work. Here, the provision of outcome feedback does not clarify or confirm this knowledge of cause and effect relationships in treatment (Hirst, 1987; Wall et al., 2002), and perceived competence will remain low. Only process feedback can help to increase the self-efficacy and confidence of these employees with regard to the task requirements, by providing insight in the required (problem solving) actions leading to optimal treatment results (Hall, 2008; Holmberg, 2006; Wall et al., 2002).

With respect to the meaning component of empowerment, with higher levels of task uncertainty, the difficulty to link actions to a task's requirements causes employees to experience less meaning in their work. Outcome feedback will not increase this level of meaning, since it will not provide insight in the cause and effect relationships in treatment (Earley et al., 1990; Hirst, 1987; Wall et al., 2002). Only the provision of process feedback will enhance meaning, since it will clarify the linkages between treatment methods and treatment requirements, enhancing feelings of work engagement (Wall et al., 2002).

Based on our considerations on three components of empowerment, perceived control, perceived competence, and meaning, we define the following hypothesis:

> *Hypothesis 5: With higher levels of task uncertainty (as opposed to lower levels of task uncertainty), the introduction of process feedback (as opposed to outcome feedback) will have a positive effect on perceived control, perceived competence, and meaning.*

4.5 Method

Sample

This study included 107 participants, divided over four teams. These teams were all part of a medical rehabilitation centre in The Netherlands, with over 300 employees. Here, patients with mainly physical and/or cognitive disabilities undergo treatment programs to help them reintegrate in society. The participating teams were selected on the basis of the characteristics of their main tasks with regard to the level of task uncertainty, as assessed in Chapter 3 through semi-structured interviews. Participating teams were 'heart failure' and 'chronic pain' (both assessed as low on task uncertainty), 'young children (0 to 4 years) with developmental disorders' and 'acquired brain injuries' (both assessed as high on task uncertainty).

Research Design

In the field experiment, a quasi-experimental switching-replications interrupted time-series design was used (Cook & Campbell, 1979; Cook, Campbell, & Peracchio, 1990; Judd, Smith, & Kidder, 1991; Trochim, 2001). With this, for each team multiple observations were made over the course of the experiment, in which the four participating teams functioned as the quasi-experimental groups. Then, the feedback intervention effect in one team was replicated at a later time within a team with a similar level of task uncertainty that earlier in the times-series functioned as a no-treatment control group.

Procedures

All the participating teams developed feedback systems, going through all four steps of ProMES development (Pritchard, 1990). Eventually, the four teams developed a total of 36 performance indicators. During review and approval meetings with management, three commonly used performance indicators (e.g., Campbell et al., 2000; Exworthy et al., 2003; Pritchard, Holling et al., 2002) were added to the set of performance indicators whenever teams did not develop these on their own initiative (see: Chapter 3): total effort (total hours of treatment per patient), total duration (total weeks of treatment per patient), and productiveness (total number of patients treated). An overview of all indicators used in this study is provided in Appendix C.

After ProMES development, for each team performance data on indicators were gathered weekly during a baseline period. Next, feedback was introduced in two phases. Indicators were grouped on the basis of the type of feedback (outcome versus process). Then, with the feedback intervention, first outcome feedback was introduced to the participants, and

after approximately four months, process feedback was added. In between the introduction of outcome/process feedback for two teams with the same level of task uncertainty, a minimum period of one month was inserted because of the switching-replications characteristic of the experimental design.

During the feedback intervention period, teams received weekly feedback through e-mail in which they were provided with scores on performance indicators from the preceding weeks. Scores were presented in tabular and graphic form, according to guidelines by Pritchard (1990). Additionally, teams got together monthly in one-hour ProMES feedback meetings, enabling joint reflection on feedback by following a procedure outlined by Van Tuijl & Kleingeld (1998). During these meetings, in response to the feedback reports, teams first evaluated per indicator any prior implemented improvement strategies with regard to the implementation, practicability, and perceived effectiveness of these strategies. Next, the level of (dis)satisfaction with current performance was assessed, and possible causes underlying low/high performance were determined. Finally, solutions and improvement strategies to be implemented were jointly determined and planned. At each meeting, an observer was present to record the feedback session.

Additionally, the 107 participants belonging to the four teams each received three questionnaires over the course of the baseline and feedback periods. Questionnaires were administered in writing at the end of the baseline period (Time 1), after approximately four months at the end of the outcome feedback period (Time 2), and after approximately four months at the end of the process feedback period (Time 3). With each administration, participants received a reminder after two weeks, after which they had another week to complete the questionnaire. At Time 1 the response rate was 47.7, at Time 2 it was 42.1, and at Time 3 it was 42.1. These response rates are all in compliance with the response rate norms for academic studies in the behavioral sciences, as specified by Baruch (1999). Missing data were handled through stochastic regression imputation (Taris, 2000), which resulted in a total of 70 participants (65%) for which full questionnaire data were available for all three time waves.

Measures

Reflection on Feedback

The independent variable reflection on feedback was operationalized by calculating the total amount of time a team spent on reflection on feedback per performance indicator. During each ProMES feedback meeting, an observer took notes and audio taped the full feedback

session. Afterwards, notes and audiotapes were analyzed by the observer to assess the exact amount of time spent per indicator on (a) the evaluation per indicator of the any prior implemented improvement strategies with regard to the implementation, practicability, and perceived effectiveness of these strategies; (b) the assessment of (dis)satisfaction with current performance; (c) the determination of possible causes underlying high/low performance; and (d) the determination of solutions and improvement strategies to be implemented.

Type of Feedback

The independent variable type of feedback was operationalized as in Chapter 3, through the rating of the four teams' performance indicators in randomized order on being either outcome indicators or process indicators by two independent judges. On the basis of a short description of each ProMES indicator, 45 performance indicators were rated independently by each judge on the type of indicator (ICC = .98). After the rating and calculation of the interrater agreement, the indicators where the two judges did not fully agree were discussed until full agreement was accomplished.

Task Uncertainty

The independent variable task uncertainty was operationalized by coding each indicator on the basis of the level of uncertainty of the task it belonged to. This level of task uncertainty was assessed on the basis of the semi-structured interviews with 27 employees from the rehabilitation centre (including managers, rehabilitation specialists, and employees from several medical disciplines), as described in Chapter 3. Here, the main tasks of teams were rated jointly by two interviewers on being either low or high on task uncertainty.

Effect Size

The dependent variable for the ProMES feedback intervention was the effect size, which was calculated for each ProMES performance indicator on the basis of the performance scores over time. Different from more traditional ProMES analyses, no overall effectiveness scores were used to calculate the effect sizes, because of the current research design in which scores were analyzed separately for the outcome and process indicators. In addition, as with more traditional ProMES analyses, scores on the performance indicators are comparable across time, not across indicators, because of the uniqueness of each performance indicator and accompanying score levels. Therefore, to be able to test for differences in effects on performance between indicators, procedures often applied to ProMES studies were followed

(see: Pritchard et al., 2008; Pritchard, Paquin et al., 2002): The effect size for each indicator was operationalized by calculation of the *d*-score (Hunter et al., 1982), being the increase in mean scores on the indicator from the baseline to the feedback period divided by the pooled standard deviation (see also: Hunter & Schmidt, 2004). On the basis of the treatment programs of the different teams, per indicator rationally foreseen delays in feedback effectiveness were taken into consideration in determining the moment of transition from baseline to feedback period. Also, prior to calculation of each *d*-score, on the basis of visual inspection, outliers were identified. After confirmation through the ARIMA additive method, outliers were removed from the dataset. In addition, any missing data were replaced with the mean of the intervention period concerned (baseline or feedback period).

Underlying Psychological Factors

The dependent variables coping with task uncertainty, task information sharing, role clarity, and empowerment (consisting of three subdimensions: perceived control, perceived competence, and meaning) were assessed by means of a questionnaire. All items in the questionnaire were in Dutch, and were rated by participants on a 5-point Likert scale, ranging from *strongly disagree* (1) to *strongly agree* (5). The dimensionality of the items in the questionnaire was examined at Time 1 by using Maximum Likelihood factor analysis with Varimax rotation, which revealed six factors accounting for 73.8% of the item variance; coping with task uncertainty (Eigenvalue = 2.19), task information sharing (Eigenvalue = 3.23), role clarity (Eigenvalue = 9.39), and the three subdimensions of empowerment: perceived control (Eigenvalue = 1.88), perceived competence (Eigenvalue = 1.08), and meaning (Eigenvalue = 1.40).

Coping with task uncertainty. Coping with task uncertainty was measured by a 4-item scale specifically developed for this study. Items were: "I know for each patient how to realize the patient's treatment goals", "My experiences with former patients help in determining the treatment method for new patients", "I know for each patient how to successfully complete the patient's treatment in time", and "My experiences with former patients help me determine how to successfully complete the treatment of new patients in time". Cronbach's alpha's for Time 1, Time 2, and Time 3 were respectively .84, .90, and .85.

Task information sharing. Task information sharing was measured by a 6-item scale specifically developed for this study. Items were: "I know what I should inform fellow-team members about in the interest of the job", "I think it's clear to whom I should communicate what to enhance team performance", "It's clear to me about what we, as team members,

should keep each other informed to be able to do a good job", "I sufficiently inform fellow-team members about matters important for the job", "I communicate with the right persons about the right matters to enhance team performance", and "I keep my team members sufficiently informed about important matters to be able to do a good job as a team". Cronbach's alpha's for Time 1, Time 2, and Time 3 were respectively .90, .94, and .88.

Role clarity. Role clarity was measured by making use of a 7-item scale developed by Rizzo, House, and Lirtzman (1970). Example items are "I know exactly what is expected from me", "I have clear, planned goals and objectives for my job", and "I know what my responsibilities are". Cronbach's alpha's for Time 1, Time 2, and Time 3 were all .92.

Empowerment. Empowerment was measured by making use of two subscales from a 9-item scale developed by Menon (2001). This scale consists of three subscales: perceived control, perceived competence, and goal internalization. Menon's 3-item subscale regarding goal internalization was replaced in the current study with a 3-item subscale of empowerment as measured by Spreitzer (1995; 1996): meaning. Menon's and Spreitzer's measures of empowerment show great overlap (Menon, 2001). However, Menon's goal internalization refers to "the energizing effect of ideas, such as an inspirational goal" (Menon, 2001, p. 175), while on the other hand, Spreitzer's meaning refers to "a fit between the requirements of a work role and a person's belief, values, and behaviors" (Spreitzer, 1996, p. 484). As said in the Introduction section, the latter better connects with the perceived relation between values, behaviors and work role requirements, relevant for the current study. Example items of the resulting empowerment scale are "I have the authority to make decisions at work" (perceived control), "I have the capabilities required to do my job well" (perceived competence), and "The work I do is meaningful to me" (meaning). For perceived control, Cronbach's alpha's for Time 1, Time 2, and Time 3 were respectively .84, .86, and .85. For perceived competence, alpha's were respectively .78, .90, and .92. For meaning, alpha's were respectively .83, .89, and .82.

Data Analysis

Analysis of covariance with post hoc independent-samples *t* tests was used to test Hypothesis 1, with *d*-score as the dependent variable. A 2 (low vs high reflection on feedback) × 2 (outcome vs process feedback) × 2 (low vs high task uncertainty) factorial design was used and eight experimental groups were identified in the data on the basis of the three independent variables reflection on feedback, type of feedback, and task uncertainty. Two of these variables were already dichotomous: type of feedback (outcome versus process) and

task uncertainty (low versus high). The continuous reflection on feedback variable was dichotomized (Cohen & Cohen, 1983) based on a median split (*Mdn* = 471.0 seconds), resulting in a low and a high reflection on feedback group. In addition, team was used as covariate, to account for variance at the team level.

Multivariate repeated measures ANOVA with post hoc paired-samples *t* tests was used to test Hypotheses 2 to 5. In the repeated measures ANOVA, the within-subjects variables were the questionnaire measures at the three time waves: coping with task uncertainty, task information sharing, role clarity, and the three components of empowerment, perceived control, perceived competence, and meaning. The between-subjects factor was the level of task uncertainty (low versus high task uncertainty).

4.6 Results

ProMES Effectiveness

On average, for the performance indicators the baseline period consisted of 43 data points, and the feedback period of 21 data points. Of the 45 original indicators, 2 showed no variability in their (maximal) scores and were removed from the data set, leaving 43 indicators to be included in the analyses. Overall, the ProMES feedback intervention had a mean effect size of d = .31 (SD = 1.07), indicating that, on average, the mean score on performance in the intervention period was .31 standard deviations higher than the mean score on performance in the baseline period.

Analysis of Covariance

Table 4.1 provides the means and standard deviations for *d*-scores at different levels of reflection on feedback, task uncertainty, and type of feedback. The results for the ANCOVA indicated a significant effect for type of feedback, $F(1,34) = 14.35$, $p < .01$, partial $\eta^2 = .30$. Additionally, the results indicated a significant interaction effect between level of reflection on feedback, level of task uncertainty, and type of feedback, $F(1,34) = 5.25$, $p < .05$, partial $\eta^2 = .13$.

Table 4.1

Means and standard deviations for d-score.

		Type of feedback			
		Outcome feedback at Time 2		Process feedback at Time 3	
Level of reflection on feedback	Level of task uncertainty	*M*	*SD*	*M*	*SD*
High	High	-.75	.50	1.20*	1.37
	Low	-.01	.59	.65	.90
Low	High	-.26	.11	.24	.56
	Low	-.07	.18	1.88	2.27

Note. *Mean for process feedback differs at $p \leq .05$ from mean for outcome feedback.

Figure 4.1 shows the interaction between type of feedback and task uncertainty when reflection on feedback is high. Independent-samples *t* tests for higher levels of reflection on feedback revealed that with higher levels of task uncertainty, *d*-scores on process feedback at Time 3 differed significantly from *d*-scores on outcome feedback at Time 2 ($t(8) = 2.70$, $p = .03$). Alternately, with lower levels of task uncertainty, *d*-scores on process feedback at Time 3 did not differ significantly from *d*-scores on outcome feedback at Time 2 ($t(12) = 1.65$, $p = .12$), and the mean *d*-score for Time 2 and Time 3 combined was .21 ($SD = .73$).

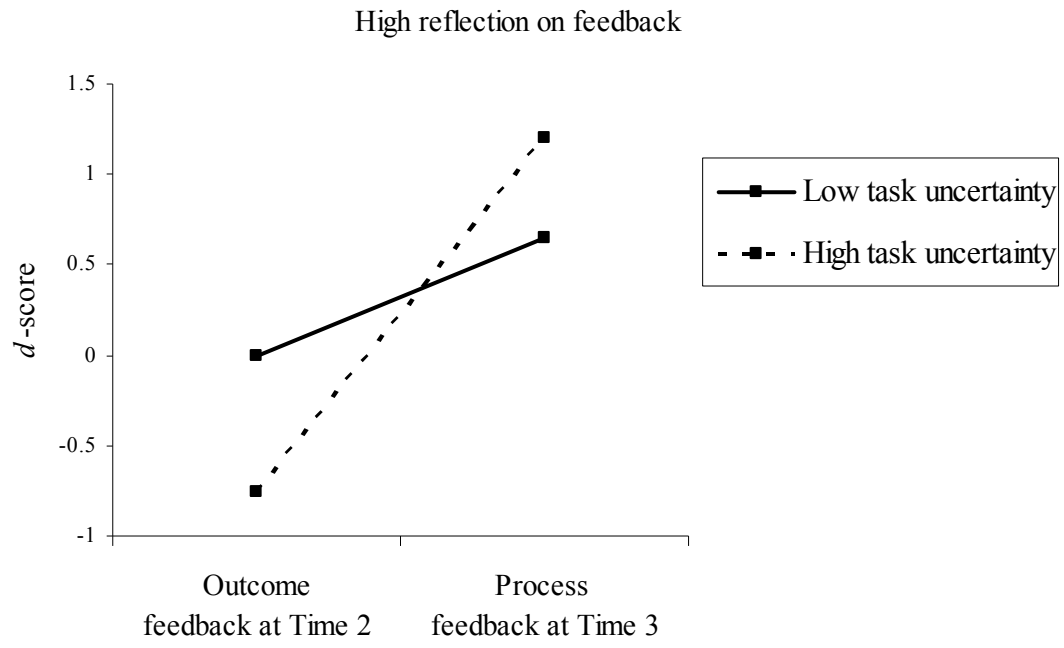

Figure 4.1: High reflection on feedback: Interaction between type of feedback and task uncertainty

Figure 4.2 shows the interaction between type of feedback and task uncertainty when reflection on feedback is low. Independent-samples *t* tests for lower levels of reflection on feedback revealed that with higher levels of task uncertainty, *d*-scores on process feedback at Time 3 did not differ significantly from *d*-scores on outcome feedback at Time 2 ($t(6) = 1.21$, $p = .27$), and the mean *d*-score for Time 2 and Time 3 combined was .16 ($SD = .48$). Alternately, with lower levels of task uncertainty, *d*-scores on process feedback at Time 3 did not differ significantly from *d*-scores on outcome feedback at Time 2 ($t(9) = 1.49$, $p = .28$), and the mean *d*-score for Time 2 and Time 3 combined was .25 ($SD = 1.27$).

These results support Hypothesis 1: Only with higher levels of reflection and higher levels of task uncertainty is the effectiveness of outcome feedback lower than the effectiveness of process feedback.

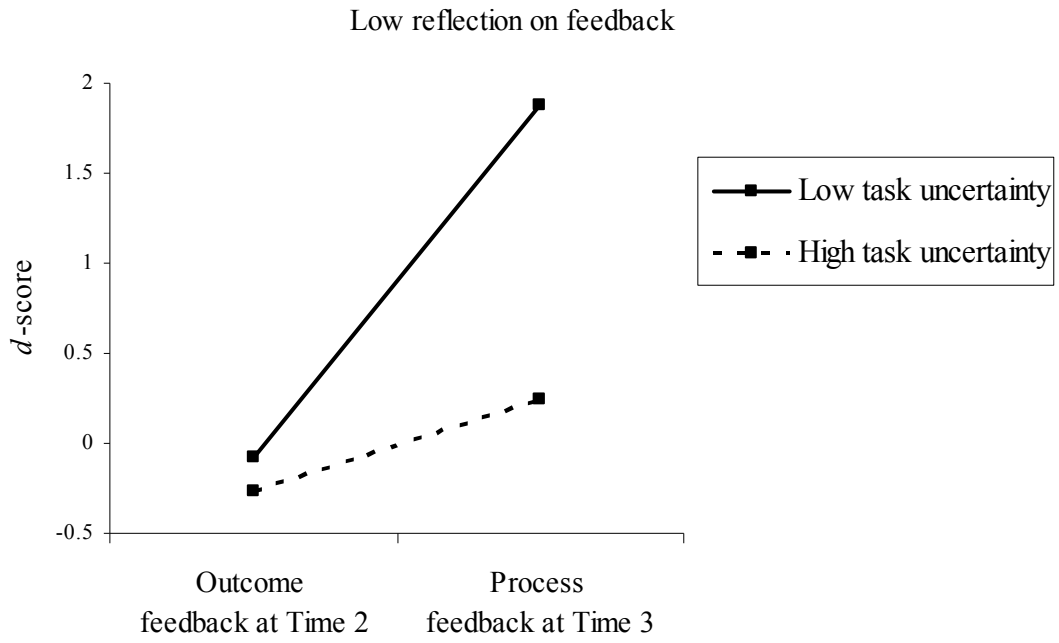

Figure 4.2: Low reflection on feedback: Interaction between type of feedback and task uncertainty

Multivariate Repeated Measures Analysis of Variance

Table 4.2 provides the means and standard deviations for all questionnaire measures. The results for the ANOVA indicated a significant effect for task uncertainty, Wilks's $\Lambda = .72$, $F(12,57) = 1.89$, $p < .01$, partial $\eta^2 = .29$. Additionally, the results indicated a significant interaction effect between time and task uncertainty, Wilks's $\Lambda = .68$, $F(6,63) = 2.25$, $p < .05$, partial $\eta^2 = .32$. These results do not appear to be influenced by the level of reflection on feedback: An additional between-within ANOVA revealed that the total time spent on reflection on feedback did not differ significantly for the within time periods effect (Wilks's $\Lambda = .99$, $F(1, 41) = .22$, $p = .64$), nor for the interaction effect between time period and task uncertainty (Wilks's $\Lambda = .97$, $F(1, 41) = 1.49$, $p < .23$). Thus, our findings regarding coping with task uncertainty, task information sharing, role clarity, and empowerment can be solely attributed to the type of feedback and the level of task uncertainty, and not to differences in levels of reflection on feedback.

Table 4.2

Means and standard deviations for all measures.

		Time period					
		Time 1		Time 2		Time 3	
Measure	Level of task uncertainty	*M*	*SD*	*M*	*SD*	*M*	*SD*
Coping with task uncertainty	High	3.61	1.18	3.79	.17	4.11*	.39
	Low	4.20	.67	4.03*	.40	4.08	.47
Task information sharing	High	3.57	1.03	3.60	.81	4.02***	.42
	Low	4.00	.70	4.10	.67	4.00	.58
Role clarity	High	3.22	1.14	3.33	.90	3.76***	.52
	Low	3.80	.81	3.90	.66	3.82	.63
Perceived competence	High	4.06	.73	3.82	1.25	4.26*	.33
	Low	4.38	.66	4.45	.39	4.55	.43
Perceived control	High	3.71	.88	3.74	.89	3.91*	.62
	Low	3.71	.94	3.68	.70	3.73	.81
Meaning	High	4.35	.59	4.27*	.57	4.40*	.52
	Low	4.33	.67	4.27	.74	4.31	.64

Note. ***Mean differs at $p \leq .001$ from previous time period. **Mean differs at $p \leq .01$ from previous time period. *Mean differs at $p \leq .05$ from previous time period.

Coping with task uncertainty. The interaction between time and task uncertainty for coping with task uncertainty is plotted in Figure 4.3. Independent-samples *t* tests revealed that for employees dealing with higher levels of task uncertainty, coping with task uncertainty did not change significantly from Time 1 to Time 2 ($t(40) = 1.53$, $p = .13$), and scores remained relatively low. However, coping with task uncertainty increased significantly from Time 2 to Time 3 ($t(40) = 2.26$, $p = .03$), indicating that coping with task uncertainty only

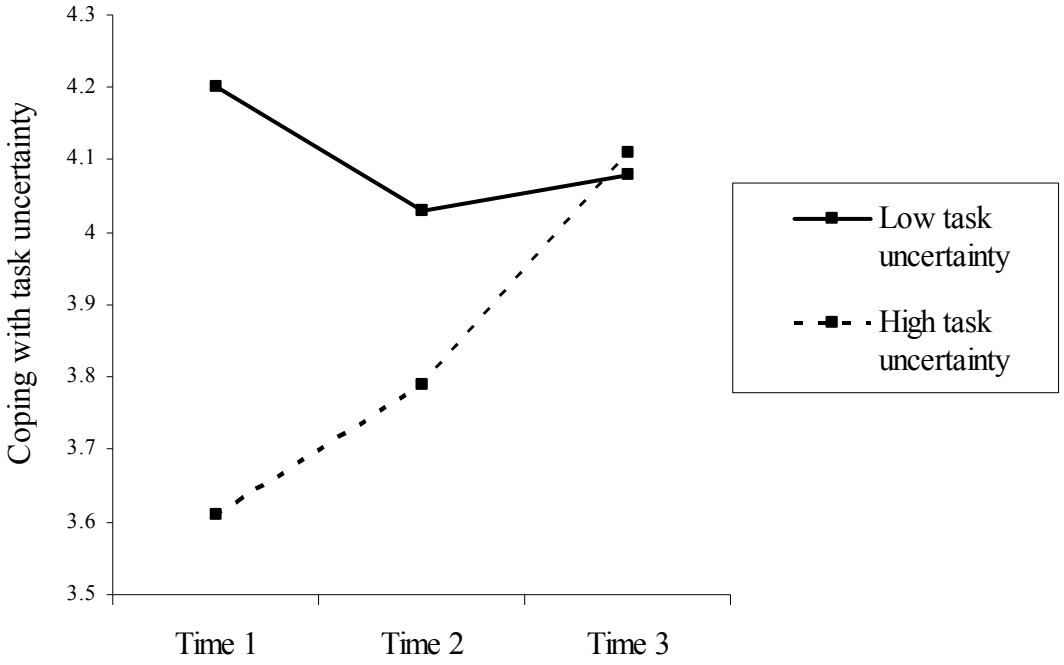

Figure 4.3: Coping with task uncertainty over time for the two levels of task uncertainty

increased after the introduction of process feedback, not after the introduction of outcome feedback. These results support Hypothesis 2. On the other hand, quite unexpectedly, employees dealing with lower levels of task uncertainty showed a significant decrease in coping with task uncertainty after the introduction of outcome feedback ($t(28) = -2.16$, $p = .04$) at Time 2. In addition, as expected, no significant change was observed after the introduction of process feedback at Time 3, and scores remained relatively high throughout the course of the field experiment.

Task information sharing. The interaction between time and task uncertainty for task information sharing is provided in Figure 4.4. Independent-samples *t* tests showed that for employees dealing with higher levels of task uncertainty, task information sharing did not change significantly from Time 1 to Time 2 ($t(40) = .29$, $p = .78$), and scores remained relatively low. However, a significant increase was observed from Time 2 to Time 3 ($t(40) = 3.85$, $p = .00$), indicating that task information sharing only increased after the introduction of process feedback, not after the introduction of outcome feedback. This supports Hypothesis 3. Alternately, for employees dealing with lower levels of task uncertainty, as expected, no significant changes were observed after the introduction of outcome or process feedback, and

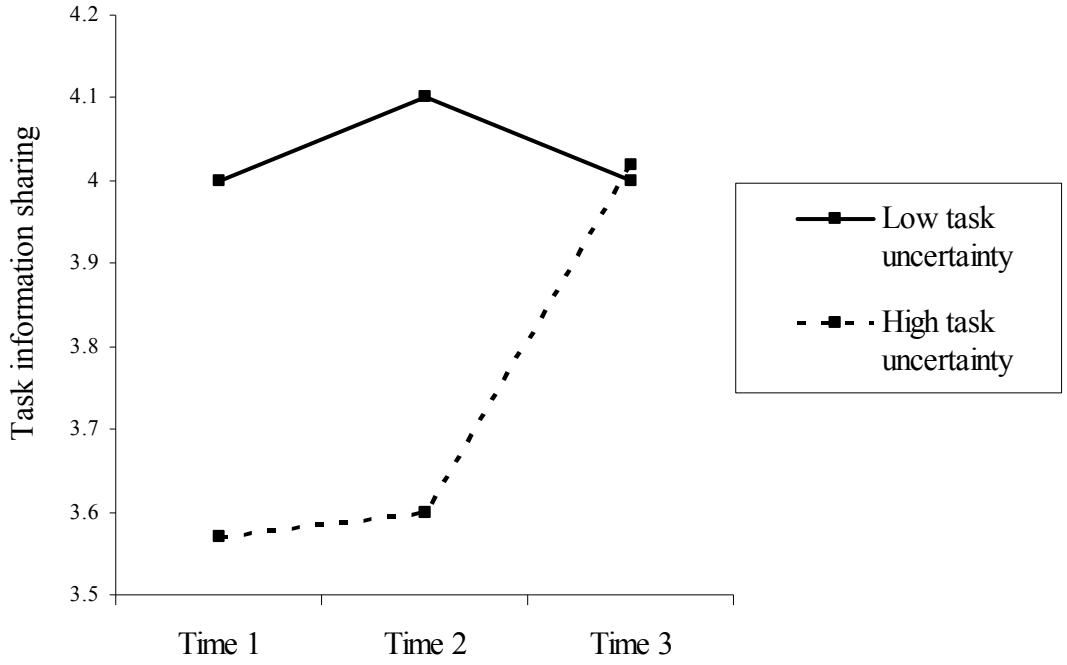

Figure 4.4: Task information sharing over time for the two levels of task uncertainty

scores on task information sharing remained relatively high throughout the course of the experiment.

Role clarity. The interaction between time and task uncertainty for role clarity is provided in Figure 4.5. Independent-samples *t* tests indicated that for employees dealing with higher levels of task uncertainty, role clarity did not change significantly from Time 1 to Time 2 ($t(40) = 1.22$, $p = .23$), and scores remained relatively low. However, role clarity significantly increased from Time 2 to Time 3 ($t(40) = 4.06$, $p = .00$), indicating that role clarity only increased after the introduction of process feedback, not after the introduction of outcome feedback. These findings support Hypothesis 4. On the other hand, for employees dealing with lower levels of task uncertainty, as expected, no significant changes were observed after the introduction of outcome or process feedback and scores on role clarity remained relatively high throughout the course of the experiment.

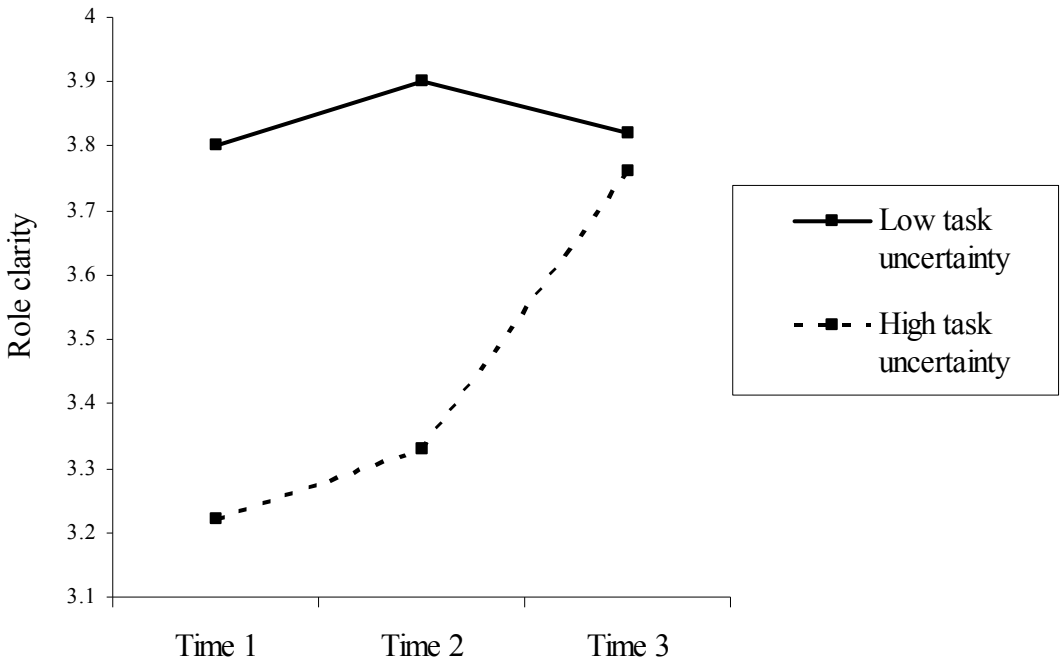

Figure 4.5: Role clarity over time for the two levels of task uncertainty

Empowerment. The interactions between time and task uncertainty for the three subdimensions of empowerment perceived competence, perceived control, and meaning are provided in respectively Figure 4.6, 4.7, and 4.8.

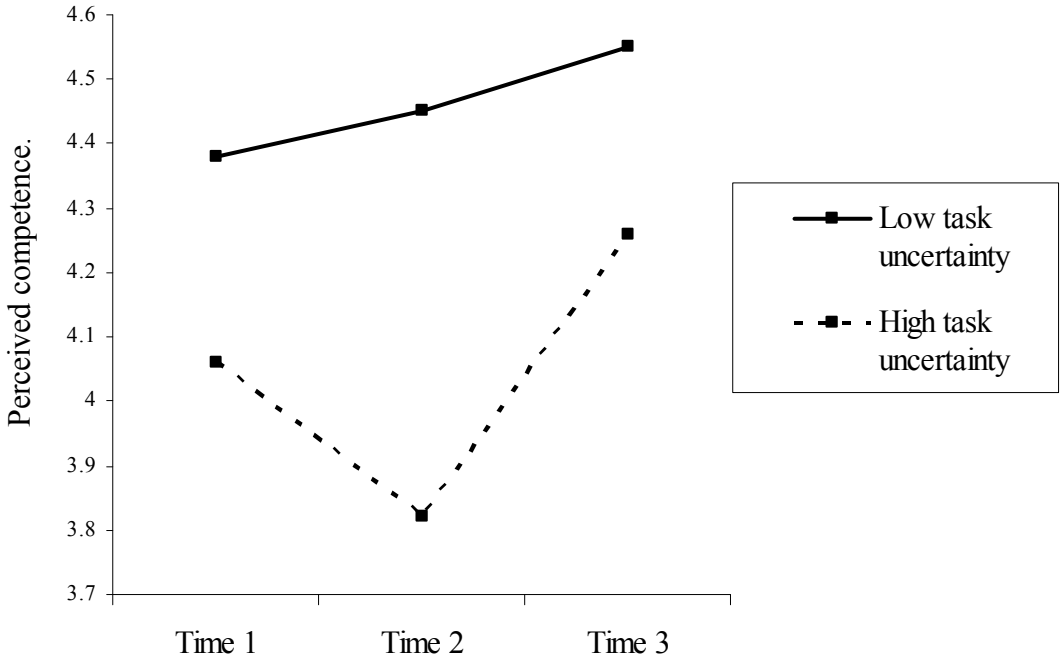

Figure 4.6: Perceived competence over time for the two levels of task uncertainty

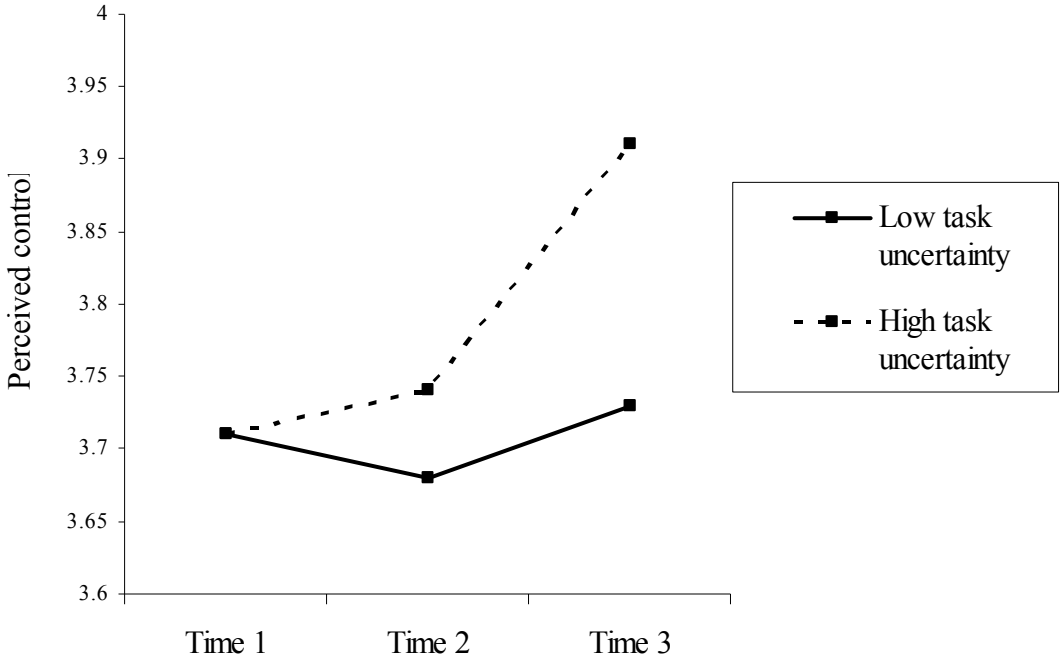

Figure 4.7: Perceived control over time for the two levels of task uncertainty

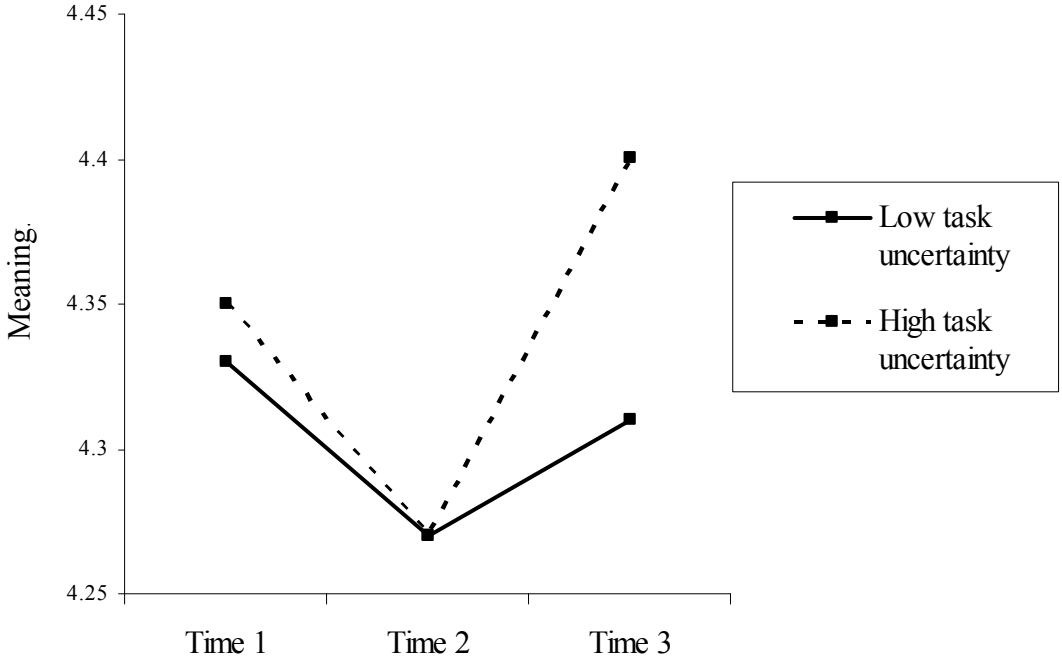

Figure 4.8: Meaning over time for the two levels of task uncertainty

Independent-samples *t* tests were conducted to evaluate the hypothesis that with higher levels of task uncertainty, only with the introduction of process feedback would feedback have a positive effect on empowerment. For employees from teams higher on task uncertainty, no significant changes were observed from Time 1 to Time 2 for perceived competence ($t(40) = -.88$, $p = .38$) and perceived control ($t(40) = .23$, $p = .82$), and scores on both these dimensions remained relatively low. Additionally, the third dimension of empowerment, meaning, decreased significantly from Time 1 to Time 2 ($t(40) = -2.19$, $p = .04$). From Time 2 to Time 3, a significant increase was observed for all three dimensions: perceived competence ($t(40) = 2.32$, $p = .03$), perceived control ($t(40) = 2.40$, $p = .02$), and meaning ($t(40) = 2.84$, $p = .01$). These results support Hypothesis 5 and even suggest that the introduction of outcome feedback may decrease meaning for employees from teams with higher levels of task uncertainty. In contrast, for employees from teams lower on task uncertainty, as expected, the introduction of outcome or process feedback did not significantly change the levels of the different dimensions of empowerment: Perceived competence and meaning remained relatively high and perceived control remained relatively low throughout the course of the experiment.

4.7 Discussion

Overall, the results of this study show that a ProMES feedback intervention on average can have a positive effect on performance in a health care setting. However, one of the two main purposes of the current study was to empirically examine the combined moderating effect of reflection on feedback, type of feedback, and task uncertainty on the effectiveness of the feedback intervention as hypothesized in Chapter 2, by making use of a quasi-experimental research design in a field setting in health care. The results of the current study support the notion of a three-way interaction between these three predictor variables.

To be specific, we predicted that with higher levels of reflection, performance would be affected by the type of feedback (outcome versus process feedback) and the level of task uncertainty. The results indicate that only with higher levels of reflection and higher levels of task uncertainty, the effectiveness of outcome feedback is lower than the effectiveness of process feedback. Here, for outcome feedback, the effect size (*d*) was -.75, indicating a large, negative effect. These findings are in line with the findings from Chapter 2, where reflection on outcome feedback had a negative effect on performance with higher levels of task uncertainty. Earley et al. (1990) already noted that outcome feedback might stimulate employees to make inappropriate adjustments in their task strategies, because of the low

perceived connection between actions and outcomes. Alternately, for process feedback, the effect size (*d*) was 1.20. To illustrate the magnitude of these effect sizes, a *d*-score of 1.20 means that performance under feedback on average is 1.20 standard deviations higher than performance under baseline. Being 1.20 standard deviations above the mean of the normal distribution means that 88% of the area under the curve is below this value. Therefore, the average performance under feedback equals what was the 88th percentile under baseline, indicating a large, positive effect. These findings are in line with the findings from Chapter 2 and possibly support Nadler's (1979) notion that process feedback should lead to more effective task strategies, when sheer effort appears to be insufficient for performance improvement (see also: Kluger & DeNisi, 1996).

On the other hand, with higher levels of reflection and lower levels of task uncertainty, the effectiveness of process feedback does not differ from the effectiveness of outcome feedback, and a positive mean effect size was observed (mean d = .21). This effect size indicates that reflection on outcome as well as process feedback has a positive effect on employees' performance with lower levels of task uncertainty, which is in line with the findings from Chapter 2. Most likely, the strong perceived connection between actions and outcomes characteristic of lower levels of task uncertainty enables these employees to make appropriate adjustments in efforts and/or task strategies (Hirst, 1987; Stinson, 2001).

We also expected that with lower levels of reflection, the introduction of feedback would have no effect on performance, irrespective of the level of task uncertainty and the type of feedback. The results indeed indicate that scores on process feedback do not differ from scores on outcome feedback under these circumstances. However, we still observed positive mean effect sizes for the high and low levels of task uncertainty (respectively, mean d = .16 and .25). Perhaps, this can be explained by the dichotomization of the reflection on feedback variable based on a median split: A low level of reflection on feedback does not imply that reflection did not take place at all. Especially with lower levels of task uncertainty, the thorough knowledge of cause and effect relationships in the task could cause even little reflection on feedback to be sufficient for adequate adjustments in applied efforts.

The second purpose of the current study was to evaluate whether employees dealing with higher levels of task uncertainty (as opposed to lower levels of task uncertainty) benefit from process feedback (as opposed to outcome feedback) with regard to coping with task uncertainty, task information sharing , role clarity, and empowerment. These psychological factors incorporate the development and use of task knowledge, which is critical with higher

levels of task uncertainty (Glasspool & Fox, 2005; Hirst, 1987; Holmberg, 2006; Stinson, 2001).

For coping with task uncertainty, the results indicate that with higher levels of task uncertainty, only the introduction of process feedback (compared to outcome feedback) has a positive effect on coping with task uncertainty. Apparently, only process feedback helps employees with determining the appropriate task methods while dealing with task uncertainty, whereas outcome feedback does not. This is in support of the task uncertainty framework as defined in Chapter 3, where only feedback on controllable process factors is believed to help employees to deal with task uncertainty. On the other hand, the results of the current study indicate that with lower levels of task uncertainty, the relatively high levels of coping with task uncertainty decrease slightly with the introduction of outcome feedback. Additionally, the introduction of process feedback does not change coping with task uncertainty. These results could indicate that employees from teams lower on task uncertainty initially tend to overestimate their knowledge of appropriate task methods to attain the desired results. When faced with outcome feedback, these employees possibly realize that the cause and effect relationships within the task are not all as they thought them to be and need to be adjusted. Next, process feedback possibly confirms the revised cause and effect relationships and no further adjustments need to be made.

For task information sharing, the results show that with higher levels of task uncertainty, only the introduction of process feedback (compared to outcome feedback) has a positive effect on task information sharing. Apparently, only process feedback helps these employees with learning about all communicational activities necessary to successfully perform their tasks, and outcome feedback does not. According to MacCrimmon and Taylor (1976), acquiring and processing more task information can help to reduce task uncertainty. Molleman and Timmerman (2003) stated that with non-routine work, knowledge sharing is crucial and in line with this, Farnan, Johnson, Meltzer, Humphrey, and Arora (2008) found through critical incident analysis for clinical decision making that sharing information with colleagues is the most important strategy to manage uncertainty for care staff. On the other hand, the results of the current study show as expected that with lower levels of task uncertainty, employees are already very well aware of the communicational activities necessary to successfully perform their tasks, and the introduction of feedback does not influence this.

For role clarity, the results indicate that with higher levels of task uncertainty, only the introduction of process feedback (compared to outcome feedback) has a positive effect on

role clarity. Apparently, only process feedback helps these employees with ascertaining their work roles, whereas outcome feedback does not. Closely related to this, Withaker, Dahling, and Levy (2007) state that role clarity mediates the relationship between feedback (seeking) and performance through knowledge acquisition: an uncertainty-reducing effect. On the other hand, the results of the current study indicate as expected that with lower levels of task uncertainty, role clarity is high and the introduction of feedback does not change this knowledge on work roles.

Finally, for empowerment, the results show that with higher levels of task uncertainty, only the introduction of process feedback (compared to outcome feedback) has a positive effect on empowerment. For employees dealing with higher levels task uncertainty, the introduction of outcome feedback did not change the relatively low levels of perceived competence and perceived control, and even decreased the relatively high level of meaning. The latter indicates that outcome feedback can reduce the meaningfulness these employees perceive in their work through a decrease of the perceived strength of the connection between their actions and the task's requirements. Only the introduction of process feedback empowers employees dealing with higher levels of task uncertainty. Molleman and Timmerman (2003) stated that when work is non-routine, employees need to be provided with the opportunity and authority to make decisions at the local level by (re)analyzing problems during task execution. Process feedback with higher levels of task uncertainty enables and stimulates these problem solving processes. On the other hand, the results of the current study show as expected that with lower levels of task uncertainty, perceived competence and meaning are high, perceived control is low, and the introduction of feedback does not change these levels of empowerment.

Practical Implications

When developing performance management systems to define the quality of care, health care organizations should take into consideration the levels of task uncertainty characteristic of the different treatment processes. With higher levels of task uncertainty, feedback should be provided on the treatment process, not on the final treatment results. Only then will care staff be enabled, through reflection, to improve on performance and on factors such as coping with task uncertainty, task information sharing, role clarity, and empowerment, promoting the development and use of task knowledge. With lower levels of task uncertainty, feedback can be provided on the treatment process, as well as the final treatment results, and even low levels of reflection might cause performance improvements.

Strengths and Limitations

The research described in this paper has several strengths. First, in the current study, a clear distinction was made in the set of performance indicators between outcome and process indicators serving as the basis for feedback. Unique in this research, outcome and process feedback were sequentially introduced, enabling the distinct examination of the effects of these two types of feedback on performance and on underlying psychological factors. Second, by making use of the quasi-experimental switching-replications interrupted time-series design, several validity threats to making causal statements were precluded. Especially the threat of history (alternative explanations associated with external events), otherwise a severe threat to internal validity in quasi-experimental time-series designs, was prevented from being of influence on our findings (Cook & Campbell, 1979; Cook et al., 1990; Judd et al., 1991). Additionally, particularly the threats of maturation (alternative explanations associated with subjects' natural growth), testing (alternative explanations associated with subjects' familiarity with testing), and instrumentation (alternative explanations associated with changes in measurement methods), were prevented from influencing our findings by making use of the current research design. Third, participants were all practitioners from the field, advocating the practical relevance of our findings. Fourth, the effect sizes assessed in the current study are based on specific indicators and performance was assessed over long periods of time, enhancing the robustness of our findings. Fifth, the four teams that participated in this research all were at a very similar level of learning and development as specialistic teams (SRCB, 2004), preventing our findings to be influenced by differences in levels of training.

There are also some limitations in the present research. First, the context of the research was restricted to the field of health care, limiting the generalizability of our findings to other practical contexts. Second, the number of teams that participated in this research was limited, causing the statistical power with the different analyses to be less than optimal (Cohen, 1988). However, this limited sample size makes the hypothesized findings that were significant even more impressive. Third, to enable the collection of sufficient data points in the time-series, a weekly feedback frequency was used. Moreover, this frequency was used with all teams, to be able to rule out feedback frequency as a possible source of variance. However, according to Pritchard and his colleagues (e.g., Pritchard, 1990, 1995; Pritchard & Ashwood, 2008), for feedback to be maximally effective, the frequency of feedback should be established for each team through participation and should correspond to the duration of

the task cycle. By making use of a preset frequency in the current study, this condition was not met, possibly somewhat limiting feedback effectiveness. Fourth, not all teams developed outcome indicators on their own initiative. During review and approval meetings with management, several outcome indicators were added to be able to test the full factorial research design. Although the indicators that were added are very common for measuring performance, these indicators were initially not developed by the team members through participation, possibly limiting the acceptance and thereby the effectiveness of feedback on these indicators (Pritchard, 1990). Finally, in the task uncertainty framework described in Chapter 3 not only a distinction is made between outcome and process feedback, but also a further distinction between process feedback concerning problem solving actions, procedural actions, and interim results. In the current study, testing the effectiveness of feedback on the full range of indicators would have been interesting in the light of task uncertainty. However, most teams did not develop all three types of process indicators, making such analysis impossible without severely harming the validity of the set of ProMES performance indicators.

Future Research

In this study, the combined moderating effect of reflection on feedback, type of feedback, and task uncertainty on the relationship between feedback and performance was empirically examined in a field setting in health care by means of the ProMES feedback intervention. This research should be replicated with larger sample sizes, in other contexts, and with other feedback interventions to provide insight in the generalizability of our findings beyond health care and ProMES. In addition, the hypotheses should be tested under fully controlled conditions through laboratory experiments, in which subjects are randomly assigned to certain and uncertain tasks, different types of feedback, and different levels of reflection on feedback. Also, future research should seek for further validation of the measurement scales specifically developed for this research, through the assessment of concurrent and discriminant validities. Additionally, the current research has made a start with examining the effect of feedback on underlying psychological factors. Future research should attempt to define an integrated model for the effect of (different types of) feedback on performance, taking concepts such as task uncertainty, task information sharing, role clarity, and empowerment into consideration.

Conclusions

This research shows through a quasi-field experiment that the effectiveness of feedback is dependent on the level of reflection on feedback, the type of feedback, and the level of task uncertainty. Employees dealing with higher levels of task uncertainty need to be presented with the opportunity to develop and use appropriate task knowledge. Reflection on process feedback provides such an opportunity.

Chapter 5

General Discussion

In this dissertation, three studies were presented to address task uncertainty, type of feedback, and reflection on feedback as moderating conditions for feedback effectiveness. In the light of the main research question, the findings from these studies are summarized in this final chapter. Furthermore, the implications of these findings for theory and practice are discussed. In addition, based on a specification of the strengths and limitations of the current research, suggestions for future research are provided.

Ever since researchers have been examining the effects of feedback interventions, feedback has been assumed to unconditionally enhance employee performance (see: Ammons, 1956; Kopelman, 1982). Only fairly recently, researchers have come to realize that findings regarding feedback effectiveness have not been consistent (e.g., Alvero et al., 2001). Kluger and DeNisi (1996) already suggested that several characteristics of feedback and task might act as moderators. However, until now, these moderating conditions remained poorly understood. The current dissertation aimed to contribute to the understanding of the inconsistencies in previous findings. Several until now underexplored moderating conditions for feedback effectiveness were examined, including task uncertainty, type of feedback, and reflection on feedback. In the preceding chapters, three studies were presented, which addressed the main research question of this dissertation: Dependent on the level of task

uncertainty, what type of feedback should employees be provided with for feedback to be effective?

Feedback refers to providing employees with information about their performance (Nadler, 1979) and it is an often used intervention to manage the performance of employees (e.g., Ilgen & Moore, 1987; Kluger & DeNisi, 1996). A feedback intervention is believed to enhance task performance by influencing the effort and/or development and use of appropriate task strategies (e.g., Kluger & DeNisi, 1996; Nadler, 1979; Pritchard et al., 2008). However, for feedback to be effective, employees should sufficiently reflect upon this feedback (De Dreu, 2002, 2007; Frese & Zapf, 1994; Hackman et al., 1976; Pritchard et al., 2008; Salas et al., 2005; West, 1996), attempting to identify causes of increased and decreased performance and to develop and later evaluate improvement strategies (Pritchard, 1990; Van Tuijl & Kleingeld, 1998). In the current dissertation, it was argued that feedback has a positive effect on performance, as long as it is sufficiently reflected upon and as long as the right type of indicator is used as the basis for feedback, dependent on the level of task uncertainty.

In line with a definition proposed by Hirst (1981; 1987; see also: Stinson, 2001), task uncertainty is the degree to which tasks are open to chance-based, task relevant influences. Thus, interruptions that simply keep one from performing a task without changing the nature of the task do not influence the level of task uncertainty; instead, such interruptions refer to environmental uncertainty. Inspired by MacCrimmon and Taylor (1976), task uncertainty is considered to refer to five elements of a task, as described in the task uncertainty framework in Chapter 3 of the current dissertation: (a) the specificity of the initial problem diagnosis (i.e., the precision with which the task assignment can be described); (b) the specificity of the task strategy (i.e., the precision with which task behaviors can be described); (c) the predictability of interim task results (i.e., the likeliness of obtaining a certain amount and type of interim product during task execution); (d) the predictability of task duration (i.e., the likeliness of fulfilling a task within a preset amount of time and effort); and (e) the predictability of end task results (i.e., the likeliness of obtaining a certain amount and type of end product after task execution). The level of task uncertainty increases as these task elements are lacking to a greater extent.

With lower levels of task uncertainty, employees know with great accuracy which task methods to use and which results can be expected, because of the deterministic and strong connection between actions and results (e.g., Hirst, 1981). Here, employees thus have fairly complete cause and effect knowledge. In the current dissertation it was argued that

under these circumstances, 'classical' feedback regarding the final results of a task delivered to the environment/customer (outcome feedback) would be sufficient for purposeful adjustments of effort and/or task strategies. Through reflection, this type of feedback could be effective with lower levels of task uncertainty.

However, with higher levels of task uncertainty, it was argued that with the provision of feedback, the focus should be shifted towards task processes. Under these circumstances, knowledge on cause and effect relationships within the task is and remains far less complete, because of uncertain influencing factors (e.g., Hirst, 1987; MacCrimmon & Taylor, 1976). Therefore, outcome feedback does not provide employees insight in the consequences of their actions, severely limiting the possibility to develop and implement accurately aimed performance improvement strategies (e.g., Holmberg, 2006). Only feedback regarding the task processes (process feedback) could help employees dealing with higher levels of task uncertainty to successfully fulfill a task. Here, with each task, employees should be stimulated to generate and adjust new behavioral routes during task execution (e.g., Holmberg, 2006; MacCrimmon & Taylor, 1976). Process feedback on such problem solving actions facilitates this. Through reflection, this type of feedback could be highly effective with higher levels of task uncertainty.

5.1 Main Findings and their Relation to Existing Literature

To examine this combined moderating effect of task uncertainty, reflection on feedback, and type of feedback on feedback effectiveness, three different yet related studies were conducted, described in the foregoing chapters of this dissertation. In Chapter 2, meta-analytical research on 83 heterogeneous field studies revealed that with lower levels of task uncertainty, employee performance could be enhanced by providing these employees with any type of feedback: outcome or process feedback. However, with higher levels of task uncertainty, employees need to be provided with process feedback in order for feedback to be effective. These findings support the contention of for example Hirst (1981; 1987) that outcome feedback might only be effective when task uncertainty is low, and employees can apply their extensive cause and effect knowledge to purposefully adjust their efforts and/or task strategies (see also: Holmberg, 2006; Stinson, 2001). In addition, reflection on feedback appeared to be an important precondition for any type of feedback to have a positive effect on performance. These findings support research by for example West and his colleagues (e.g., Carter & West, 1998; West, 1996), in which a positive relation between reflection on team work and team performance was stressed. Furthermore, the findings from the current research

add to this notion, by making clear that reflection should take place on the right type of indicator, dependent on the level of task uncertainty, in order for reflection to have a positive effect on performance. The results from the research described in Chapter 2 even suggest that reflection on the wrong type of indicator (outcome feedback with higher levels of task uncertainty) could lead to a significant decrease in performance. Possibly, intensive reflection on outcome feedback causes employees dealing with higher levels of task uncertainty to spent their efforts on ineffective or even hindering actions because of limited cause and effect knowledge, as suggested by for example Earley, Northcraft, Lee and Lituchy (1990).

In line with the above, in Chapter 3 quasi-field experimental research on 50 care providing workers divided over 8 medical rehabilitation teams revealed that in using the ProMES method, teams higher on task uncertainty develop relatively more process indicators (compared to outcome indicators) than teams lower on task uncertainty. In support of these findings, Russell (1998) stated that with uncertain processes, outcomes provide an invalid basis for task strategy adaptations, because of insufficient controllability of these outcomes, through which insight in cause and effect relationships is limited. Related to this, Pritchard and his colleagues (e.g., Pritchard, 1992; Pritchard & Ashwood, 2008; Pritchard, Paquin et al., 2002) noted that a lack of controllability of an indicator severely limits the use of that indicator in a valid, effective performance management system, making controllability one of the most important design requirements for performance indicators. In addition, in line with the task uncertainty framework described in Chapter 3, teams higher on task uncertainty develop relatively more problem solving process indicators (compared to other types of process indicators) than teams lower on task uncertainty. This supports the contention of MacCrimmon and Taylor (1976) that with higher levels of task uncertainty, employees need strategies to develop new task methods. By stimulating employees to repetitively engage in problem solving actions, alternative task methods can be generated and tested, enabling well-founded decision making (see also: Holmberg, 2006). On the other hand, in line with the task uncertainty framework described in Chapter 3, teams higher on task uncertainty develop relatively less procedural process indicators (compared to other types of process indicators) than teams lower on task uncertainty. These results are supported by findings by Gilson, Mathieu, Shalley, and Ruddy (2005), who discovered that following standardized task procedures enhanced performance under familiar, certain conditions.

In Chapter 4, the findings from Chapter 2 were empirically tested in quasi-field experimental research on 107 care providing workers divided over 4 medical rehabilitation teams. With this, the indicators developed in Chapter 3 were used as the basis for feedback.

The results of this experiment revealed that only when task uncertainty and feedback reflection are both high, the effectiveness of outcome feedback is lower than the effectiveness of process feedback. With other levels of task uncertainty and/or feedback reflection, the effectiveness of outcome feedback does not differ from the effectiveness of process feedback. These findings are in line with the results found in Chapter 2, and support the contention that with higher levels of task uncertainty, outcome feedback may have a negative effect on performance, and only process feedback may lead to better task strategies that enhance performance (e.g., Earley et al., 1990; Hirst, 1987; Stinson, 2001).

In addition, by means of repeated questionnaires, in Chapter 4 the effects of different types of feedback on relevant psychological factors were sequentially examined for different levels of task uncertainty. The results revealed that employees dealing with higher levels of task uncertainty benefit only from process feedback (as opposed to outcome feedback) with regard to coping with task uncertainty, task information sharing, role clarity, and empowerment. These underlying factors all incorporate the development and use of task knowledge. As opposed to the application of sheer effort (e.g., Earley et al., 1990), this ability and opportunity to acquire task knowledge is believed to be critical with higher levels of task uncertainty (e.g., Glasspool & Fox, 2005; Hirst, 1987; Wall et al., 2002), and performance management should focus on work processes (e.g., Molleman & Timmerman, 2003).

With regard to coping with task uncertainty, employees need to have accurate knowledge about the most appropriate methods to successfully complete a task (e.g., Edwards & Weary, 1998; Hirst, 1987; Holmberg, 2006). In the current research, only the provision of process feedback enables employees dealing with high levels of task uncertainty to link task methods to task results. By clarifying and stimulating the required problem solving strategies (see also: MacCrimmon & Taylor, 1976; Wall et al., 2002) reflected in process indicators, employees learn how to optimally fulfill an uncertain task.

With regard to task information sharing, in previous research (Farnan et al., 2008) it was found through critical incident analysis that sharing task information with colleagues is the most important strategy to manage uncertainty in clinical decision making. In line with these findings, several researchers such as MacCrimmon and Taylor (1976) and Wall et al. (2002) suggested that an increase in acquiring and processing task information can help to reduce task uncertainty. In the current research, only process feedback clarifies the relevant communicational activities with higher levels of task uncertainty, by incorporating these activities in process indicators.

With regard to role clarity, Pritchard et al. (2002) indicated that only valid performance management systems with controllable indicators are able to clarify work roles. In support of this, Hall (2008) found that role clarity is positively related to comprehensive performance management systems and performance. Furthermore, Whitaker, Dahling, and Levy (2007) stated that role clarity is positively related to feedback (seeking) and performance because of knowledge acquisition, reducing uncertainty. In the current research, with higher levels of task uncertainty, only process feedback seems to enhance the acquisition of knowledge about role requirements, by clarifying the connection between expectations and activities of role fulfillment in process indicators.

Finally, with regard to empowerment, Molleman and Timmerman (2003) already suggested that when work is non-routine, employees should be given the opportunity and authority to make decisions during task execution (see also: Holmberg, 2006; MacCrimmon & Taylor, 1976; Wall et al., 2002), and decision making should be decentralized (Schoonhoven, 1981). In the current research, only process feedback enables and stimulates such empowered problem solving in highly uncertain tasks, by incorporating these activities in process indicators.

5.2 Additional Implications for Theory

Theoretically, the main findings from the research described in this dissertation relate not only to the ideas and findings of researchers mentioned above, but also to the Feedback Intervention Theory (FIT) proposed by Kluger and DeNisi (1996). These authors stated that the effect of feedback on performance is moderated by several poorly understood characteristics of feedback and task, and urged researchers to further examine these moderating conditions. The research presented in the current dissertation adds three important moderators to the understanding of feedback effectiveness: task uncertainty, type of feedback, and reflection on feedback.

In FIT, a distinction is made between task-motivation processes and task-learning processes. According to this theory, with the provision of feedback, performance on an indicator is compared with a performance standard. If performance is below expectations, either motivational or learning processes are activated. The results from the current research described in Chapter 2 and Chapter 4 indicate that these processes can only be accurately activated when reflection on feedback is employed to some extent. As an important precondition for feedback effectiveness, employees need to constructively use feedback to determine possible causes of in- or decreased performance and develop and later evaluate

specific performance improvement strategies. Whether motivational or learning improvements are made during feedback reflection is most likely dependent on the type of feedback that is provided and the level of task uncertainty, as examined in Chapter 2 and Chapter 4 of the current dissertation.

With lower levels of task uncertainty, employees can be provided with information on task outcomes as well as task processes. Because of the extensive knowledge of cause and effect relationships within a task, both types of feedback enable these employees to adequately determine the most appropriate improvement strategy. Here, through reflection, mainly motivational processes are activated, in which sheer effort can be increased on or shifted towards existing procedures (see also Chapter 3 of the current dissertation) to enhance performance. In support of the findings from the current research, Kluger and DeNisi (1996) additionally stated that when a task is well-known, learning processes could even hinder performance, because they disrupt the execution of well-tested task procedures.

On the other hand, with higher levels of task uncertainty, employees need to be provided with information on task processes. Knowledge of cause and effect relationships is limited, and outcome feedback does not provide these employees insight in the behavioral reasons behind low performance. Here, through reflection, motivational processes could be activated, in which sheer effort is increased, but it is very likely that this effort is spent on ineffective or even hindering actions, decreasing performance. In line with this, Kluger and DeNisi (1996) additionally suggested that outcome feedback might impede learning, because it could cause employees to futilely experiment with (already optimal) task methods. Only process feedback provides employees dealing with higher levels of task uncertainty insight in the required problem solving actions (see also Chapter 3 of the current dissertation) leading to optimal task results. Here, through reflection, learning processes are activated, in which employees develop, evaluate, and use better task methods. In line with the findings from the current research, Kluger and DeNisi (1996) additionally stated that learning processes might be directly activated by feedback interventions that refer to task processes.

The results from the research described in Chapter 4 additionally show that these feedback-enabled task-learning processes as described in FIT incorporate psychological factors such as empowerment, role clarity, task information sharing, and coping with task uncertainty. With higher levels of task uncertainty, reflection on process feedback provides the opportunity for such task-learning processes.

5.3 Implications for Practice

Over the last few decades, there has been a shift towards more knowledge-based work. In a wide variety of organizations, employees are therefore more and more required to be creative and deal with higher levels of task uncertainty (e.g., DeFillippi et al., 2007). Additionally, uncertainty has been and continues to be an important characteristic of a significant part of the work in health care (e.g., Franco et al., 2002; Stevenson et al., 1990). Moreover, the free-market conditions recently introduced in this field of work urge care providing organizations to more and more define and manage the quality of care (e.g., Begley et al., 2002; Russell, 1998). The Productivity Measurement and Enhancement System (Pritchard, 1990, 1995), although highly labor-intensive, offers a solid, well-validated method for such performance management.

With the development of performance management systems such as ProMES, practitioners in the field should take the level of task uncertainty employees are dealing with in their work into consideration, by making use of the task uncertainty framework defined in Chapter 3. Here, controllability of performance indicators to be developed should serve as an important guideline during development. The results of the research presented in Chapter 2 and Chapter 4 suggest that to enhance employee performance, the 'classical' focus of performance indicators on task outcomes (Kluger & DeNisi, 1996) is only justified when task uncertainty is low and employees know in detail the cause and effect relationships within a task. Otherwise, the use of process indicators should be enabled, combined with high levels of reflection on feedback to identify causes of low/high performance and to constructively plan and evaluate new work strategies during formal feedback meetings. The results of the research presented in Chapter 4 additionally suggest that such reflection on process feedback with higher levels of task uncertainty could promote employees' feelings of empowerment, role clarity, task information sharing, and coping with task uncertainty; factors believed to be very relevant for successfully executing uncertain tasks. Dependent on the level of task uncertainty, practitioners in the field should create matching organizational circumstances, facilitating these factors. For instance, employees should be provided with the opportunity to share task information during formal meetings, and the organizational structure should enable decentralized task decision making.

The results of the research presented in Chapter 3 suggest that process indicators in practice should be custom designed by means of a method such as ProMES to meet the requirements of a task, depending on the level of task uncertainty: With lower levels of task uncertainty, process indicators should be developed that stimulate the use of predefined rules

and procedures, whereas with higher levels of task uncertainty, process indicators should be developed that stimulate the use of problem solving strategies during task execution.

5.4 Strengths and Limitations

The research described in this dissertation has several major strengths. The studies presented in Chapter 2, Chapter 3, and Chapter 4 were all based on longitudinal data, especially useful to examine causality and effects over time (Taris, 2000). In addition, the meta-analytical research described in Chapter 2 had the main advantage of being based on a nearly complete database, consisting of a large variety of studies, supporting the generalizability of the practice-based findings. Moreover, the measurements of performance were based on specific indicators, assessed over long periods of time, supporting the robustness of the findings. The quasi-field experimental research described in Chapter 3 and Chapter 4 had the main advantage of being set in rehabilitation, thereby uniquely contributing to research on performance management in health care. In addition, the performance indicators used in this research were designed by professionals from the field, using a bottom-up approach, supporting the validity and practical relevance of the findings. With this, in Chapter 3 valuable qualitative insight was provided in the specific nature of the different types of (process) indicators that were developed. Furthermore, the quasi-field experimental research described in Chapter 4 had the main advantage of uniquely contributing to existing literature by empirically testing the sequential effects of outcome and process feedback on performance and on underlying psychological factors in a field setting. With this, the strong research design prevented the findings from being influenced by severe validity threats such as threat of history, maturation, testing, and instrumentation (Cook & Campbell, 1979).

There are also several limitations in this dissertation's research. The studies presented in Chapter 2, Chapter 3, and Chapter 4 all used ProMES as the method of feedback intervention, limiting the generalizability of the findings to other feedback interventions. In addition, all studies presented in this dissertation suffered from somewhat limited sample sizes, causing the statistical power to be limited (Cohen, 1988). However, this limitation makes those hypothesized findings that were significant even more impressive. Furthermore, the research described in Chapter 3 and Chapter 4 had the disadvantage of being restricted to one organization in the field of health care, limiting the generalizability of the findings. However, because of this restriction, non-accountable variance caused by organization-specific factors was prevented from influencing the quasi-field experimental findings. Finally, no integrated feedback model was tested that could comprehensively explain the

effects of feedback on performance. The research described in Chapter 2 and Chapter 4 identified task uncertainty, type of feedback, and reflection on feedback as important moderating conditions for feedback effectiveness, and the research described in Chapter 4 additionally suggested that empowerment, role clarity, task information sharing, and coping with task uncertainty play important roles in feedback effectiveness with higher levels of task uncertainty. However, although these findings clearly add to the understanding of the effect of feedback on performance, they do not imply an integrated causal model.

5.5 Future Research

The main findings from the research presented in this dissertation have shed light on the type of feedback that employees should be provided with for feedback to be effective, depending on the level of task uncertainty. These findings should be replicated in future research with other feedback interventions to provide insight in the generalizability of our findings beyond ProMES, because although feedback is the central intervention applied with ProMES, it also incorporates components such as participation and management review. Related to this, future research should examine how to considerably reduce time and effort required for ProMES development, without harming the validity of the resulting performance management system. In addition, the findings from the research presented in this dissertation should be replicated with larger sample sizes, to ensure sufficient statistical power. Moreover, the studies presented in Chapter 3 and Chapter 4 should be replicated in other contexts, to examine the generalizability of the findings. The meta-analytical research described in Chapter 2 indicates that task uncertainty, type of feedback, and reflection on feedback play important roles in feedback effectiveness in a large variety of tasks, organizations, industries, and countries. However, the effects of task uncertainty on the development of different types of indicators (Chapter 3), and on the relationship between feedback and underlying psychological factors (Chapter 4) should be validated beyond the field of health care. In addition, future research should seek for further validation of the task uncertainty framework defined in Chapter 3, to find support for the five task elements determining the level of task uncertainty. With this, future research should develop additional instruments (aside from semi-structured interviews) such as questionnaire scales, to enable an efficient and reliable method to assess levels of task uncertainty. Finally, future research should attempt to validate an integrated feedback model, comprehensively describing the effects of feedback on performance, including moderating factors such as task uncertainty, type of feedback, and reflection on feedback, and supposedly performance-enhancing factors such as

empowerment, role clarity, task information sharing, and coping with task uncertainty. Incorporating the findings from the current dissertation in for example the recently developed FIT feedback model (Kluger & DeNisi, 1996) might add to the understanding of the mechanisms through which feedback affects performance.

5.6 Conclusions

The research presented in this dissertation shows through meta-analysis and empirical field research that the effectiveness of feedback is not straightforward. Task uncertainty, type of feedback, and reflection on feedback are important moderating conditions, severely influencing the effect of feedback on performance and on underlying psychological factors such as empowerment, role clarity, task information sharing, and coping with task uncertainty. Organizations could benefit from taking these findings in consideration with the design of feedback in performance management systems.

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Appendix A

Interview Scheme to Assess the Level of Task Uncertainty within Rehabilitation Teams

Interview scheme to assess the level of task uncertainty within rehabilitation teams

Introduction

- Describe the purpose of the interview: the assessment of the level of task uncertainty of the different rehabilitation teams within the medical rehabilitation centre.
- Provide the definition of task uncertainty and explain the accompanying levels of low, intermediate and high task uncertainty, using the task uncertainty framework.

Interview questions

1. Taking into consideration the characteristics of the different levels of task uncertainty, think of two most contrasting treatment processes of different patient groups.
    a) Which two patient groups do you have in mind?
    b) Within which teams are these patient groups treated?
2. Give a description of the treatment program for the patient group with relatively high task uncertainty. Include the most important phases of the program, each decision moment and the intended (interim)results.
    a) Please describe this program step by step by using figure A.1. You can add or delete as many process elements as you need.
    b) Please indicate if and where in this program uncertainty occurs and in what form.
3. Give a description of the treatment program for the patient group with relatively low task uncertainty. Include the most important phases of the program, each decision moment and the intended (interim)results.
    a) Please describe this program step by step by using figure A.1. You can add or delete as many process elements as you need.
    b) Please indicate if and where in this program uncertainty occurs and in what form.
4. Successively repeat questions 1, 2, and 3 until the interviewee can't think of any more examples.

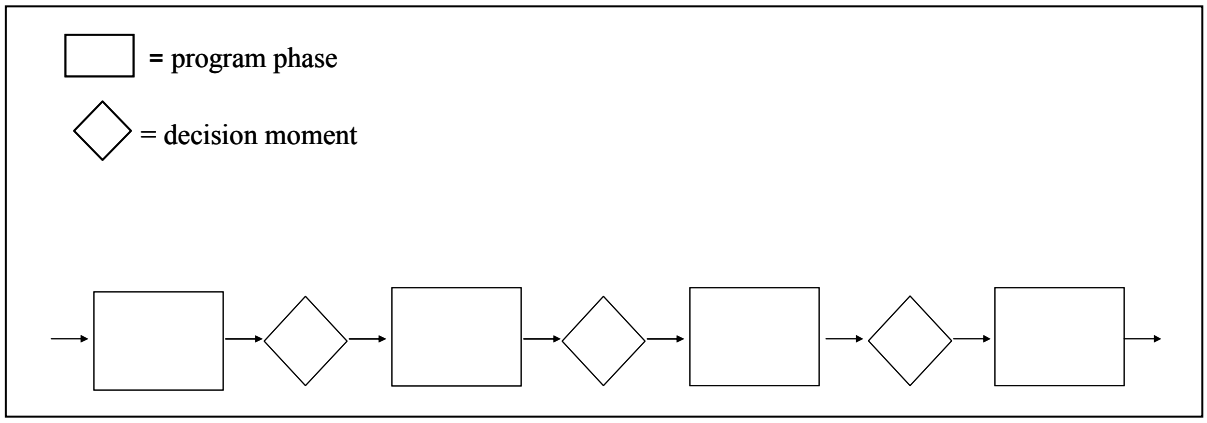

Figure A.1: Blank treatment program

Appendix B

Table with ProMES Performance Indicators per Team

Table B.1

ProMES performance indicators developed per team.

Team	Performance indicator	Type of indicator
hand trauma	number of A1 patients who followed the treatment program	outcome
	mean number of treatment hours per patient	outcome
	percentage of A1 and B patients with a throughput time > 12 weeks	outcome
	mean throughput time of A2 patients	outcome
	mean score on Kapandji for A1 patients	outcome
	mean score on Boyd for A1 patients	outcome
	mean level of strength recovery for A1 patients with an injured dominant hand	outcome
	mean level of strength recovery for A1 patients with an injured non-dominant hand	outcome
	percentage of A1 patients with a DASH score ≤ 10.2	outcome
	percentage of A2 patients with a DASH score ≤ 25	outcome
	percentage of patients with a Strickland score of *good* or *excellent*	outcome
	percentage of patients for whom the multidisciplinary meeting reports were complete	interim result
	percentage of medical treatment reports that were timely and complete	interim result
	percentage of patients for whom at least 80% of the treatment dates were reported	interim result
	percentage of patients for whom the registration program phase checklist was complete	procedural
	percentage of patients for whom the plastic surgeon phase checklist was complete	procedural
	percentage of patients for whom the observation phase checklist was complete	procedural
	percentage of patients for whom the dominant hand phase checklist was complete	procedural
	percentage of patients for whom the non-dominant hand phase checklist was complete	procedural
	percentage of patients for whom the final phase checklist was complete	procedural
heart failure	mean number of treatment hours per patient	outcome
	mean number of weeks of treatment per patient	outcome
	percentage of HM patients with a throughput time ≤ 12 weeks	outcome
	percentage of patients with an increase on the quality of physical life questionnaire	outcome
	percentage of patients with an increase on the quality of emotional life questionnaire	outcome
	percentage of patients with an increase on the quality of social life questionnaire	outcome
	percentage of patients with an increase on the shuttle walk test	outcome

Table B.1 continued

ProMES performance indicators developed per team.

Team	Performance indicator	Type of indicator
heart failure (cont.)	percentage of patients who have been summoned within 2 weeks after referral	interim result
	percentage of patients with a PEP intake who are diagnosed as PEP	interim result
	percentage of patients for whom the final medical treatment report was complete	interim result
	mean time between the final PEP meeting and the first follow-up care by phone	interim result
	percentage of patients for whom a letter has been sent within 3 weeks after discharge	interim result
	percentage of patients for whom the treatment program checklist was complete	procedural
amputation	percentage of patients with a difference in COPM score ≥ +2	outcome
	percentage of patients with a difference in COPM satisfaction score ≥ +2	outcome
	mean score on basal activities with prosthesis	outcome
	mean score on basal activities without prosthesis	outcome
	mean score on normal activities with prosthesis	outcome
	mean score on normal activities without prosthesis	outcome
	mean score on extra activities with prosthesis	outcome
	mean score on extra activities without prosthesis	outcome
	percentage of skills lists completed prior to a multidisciplinary meeting	interim result
	percentage of patients for whom the stump was stable within 2 weeks after pre-registration	interim result
	percentage of medical treatment reports that were timely	interim result
	percentage of training meetings for which the prescribed schema was followed	procedural
	percentage of multidisciplinary meetings for which goals were approved and reported in advance	procedural
	percentage of multidisciplinary meetings for which the prescribed schema was followed	procedural
	percentage of patients for whom the treatment program checklist was completed for at least 80%	procedural
chronic pain	percentage of long term treatment goals accomplished at the end of the treatment program of 12 weeks	outcome
	percentage of patients with an increase on SF-36 ≥ 50%	outcome
	percentage of patients with an equal or increased score on SF-36 at the follow-up meeting	outcome
	percentage of patients for whom the indication letter from the rehabilitation specialist was sent to all medical disciplines before the start of the observation phase	interim result

Table B.1 continued

ProMES performance indicators developed per team.

Team	Performance indicator	Type of indicator
chronic pain (cont.)	percentage of treatment goals that were formulated SMART	interim result
	percentage of medical observation- and treatment reports fully completed	interim result
	percentage of patients for whom the checklist with regard to the final consultation was complete	procedural
	percentage of multidisciplinary meetings for which the prescribed schema was followed	problem solving
children with DCD	percentage of patients with a difference in COPM score ≥ +2	outcome
	percentage of patients with a difference in COPM satisfaction score ≥ +2	outcome
	mean score on VAS satisfaction for the result of the treatment	outcome
	percentage of patients with an increase of at least 2 points on at least 2 subscales on the self competence list	outcome
	mean difference on CBSK	outcome
	percentage of patients for whom the outgoing correspondence in the observation phase was timely	interim result
	percentage of patients for whom the outgoing correspondence in the treatment phase was timely	interim result
	percentage of patients for whom the outgoing correspondence in the final phase was timely	interim result
	percentage of patients for whom the final phase procedural checklist was complete	procedural
	percentage of patients for whom the observation phase checklist was complete	problem solving
	percentage of patients for whom the final phase problem solving checklist was complete	problem solving
	percentage of patients for whom the final multidisciplinary meeting checklist was complete	problem solving
parkinson disease	percentage of treatment goals accomplished at the end of the treatment program	outcome
	mean difference scores on patients' satisfaction with the result of the treatment program	outcome
	percentage of patients for whom an additional treatment program did not need to be started to accomplish goals from a previous treatment program	outcome
	percentage of treatment goals that were formulated SMART	interim result
	percentage of patients for whom no additional treatment goals were set during treatment	interim result
	percentage of medical treatment reports fully completed	interim result

Table B.1 continued

ProMES performance indicators developed per team.

Team	Performance indicator	Type of indicator
parkinson disease (cont.)	percentage of process checklists completed for at least 80%	problem solving
	percentage of multidisciplinary meetings for which the prescribed schema was followed	problem solving
young children	percentage of children with an increase on PEDI using yearly assessments	interim result
	percentage of transfer forms after the first multidisciplinary meeting that were complete	interim result
	percentage of completed transfer forms that were up-to-date	interim result
	percentage of short term treatment goals that were formulated SMART in the medical treatment reports	interim result
	percentage of short term treatment goals accomplished prior to a multidisciplinary meeting	interim result
	percentage of medical observation and treatment reports that were timely	interim result
	percentage of completed transfer forms and transfer reports that were sent centrally	procedural
	percentage of process checklists completed with regard to treatment quality	problem solving
	percentage of process checklists completed with regard to communication with the patient	problem solving
	percentage of process checklists completed with regard to communication within the team	problem solving
	mean score on a questionnaire with regard to the internal communication	problem solving
	mean score on a questionnaire with regard to the external communication	problem solving
	percentage of multidisciplinary meetings for which all relevant external care providers were invited	problem solving
	percentage of team members who were present at the interdisciplinary meetings	problem solving
acquired brain injuries	percentage of patients for whom the WCN list was handed to the psychotherapist by all disciplines prior to the first multidisciplinary meeting	interim result
	percentage of screening reports that were handed in by the psychotherapist prior to the first multidisciplinary meeting	interim result
	percentage of short term treatment goals that were formulated SMART in the medical treatment reports	interim result
	percentage of patients who had a consultation with the rehabilitation specialist within one week after a multidisciplinary meeting	interim result

Table B.1 continued

ProMES performance indicators developed per team.

Team	Performance indicator	Type of indicator
acquired brain injuries (cont.)	percentage of patients for whom the duration of admission equaled the prognosis for the duration of admission made after the first multidisciplinary meeting (with a margin of 2 weeks)	interim result
	percentage of consultations with the rehabilitation specialist after which the short term treatment goals were handed to a patient	procedural
	percentage of observational process checklists completed with regard to the medical demand	problem solving
	percentage of observational process checklists completed with regard to treatment quality	problem solving
	percentage of observational process checklists completed with regard to efficiency	problem solving
	percentage of process checklists completed with regard to the medical demand	problem solving
	percentage of process checklists completed with regard to treatment quality	problem solving
	percentage of process checklists completed with regard to efficiency	problem solving
	percentage of teamstart meetings at which a rehabilitation specialist was present	problem solving
	percentage of multidisciplinary meetings for which the prescribed schema was followed	problem solving

Note. Per team, the indicators were divided over several or all of the following main objectives: effectiveness, efficiency, expertise, and customer satisfaction.

Appendix C

Table with Performance Indicators per Team Used for ProMES Feedback

Table C.1

Performance indicators per team used for ProMES feedback.

Team	Performance indicator	Type of indicator
heart failure	mean number of treatment hours per HE patient	outcome
	mean number of treatment hours per HM patient	outcome
	mean number of treatment hours per HC patient	outcome
	mean number of weeks of treatment per HE patient	outcome
	mean number of weeks of treatment per HM patient	outcome
	mean number of weeks of treatment per HC patient	outcome
	number of HE patients discharged	outcome
	number of HM patients discharged	outcome
	number of HC patients discharged	outcome
	percentage of HM patients with a throughput time ≤ 12 weeks	outcome
	percentage of patients with an increase on the quality of physical life questionnaire	outcome
	percentage of patients with an increase on the quality of emotional life questionnaire	outcome
	percentage of patients with an increase on the quality of social life questionnaire	outcome
	percentage of patients who have been summoned within 2 weeks after referral	process
	percentage of patients with a PEP intake who are diagnosed as PEP	process
	percentage of patients for whom the final medical treatment report was complete	process
	percentage of patients for whom the treatment program checklist was complete	process
chronic pain	mean number of treatment hours per patient	outcome
	mean number of weeks of treatment per patient	outcome
	number of patients discharged	outcome
	percentage of long term treatment goals accomplished at the end of the treatment program of 12 weeks	outcome
	percentage of patients for whom the indication letter from the rehabilitation specialist was sent to all medical disciplines before the start of the observation phase	process
	percentage of treatment goals that were formulated SMART	process
	percentage of medical observation- and treatment reports fully completed	process
	percentage of multidisciplinary meetings for which the prescribed schema was followed	process
young children	mean number of treatment hours per patient	outcome
	mean number of weeks of treatment per patient	outcome
	number of patients discharged	outcome
	percentage of short term treatment goals that were formulated SMART in the medical treatment reports	process

Table C.1 continued

Performance indicators per team used for ProMES feedback.

Team	Performance indicator	Type of indicator
young children (cont.)	percentage of short term treatment goals accomplished prior to a multidisciplinary meeting	process
	percentage of medical observation and treatment reports that were timely	process
	percentage of process checklists completed with regard to treatment quality	process
	percentage of process checklists completed with regard to communication with the patient	process
	percentage of process checklists completed with regard to communication within the team	process
brain injuries	mean number of treatment hours per patient	outcome
	mean number of weeks of treatment per patient	outcome
	number of patients discharged	outcome
	percentage of patients for whom the WCN list was handed to the psychotherapist by all disciplines prior to the first multidisciplinary meeting	process
	percentage of patients for whom the duration of admission equaled the prognosis for the duration of admission made after the first multidisciplinary meeting (with a margin of 2 weeks)	process
	percentage of observational process checklists completed with regard to treatment quality	process
	percentage of observational process checklists completed with regard to efficiency	process
	percentage of process checklists completed with regard to the medical demand	process
	percentage of process checklists completed with regard to treatment quality	process
	percentage of process checklists completed with regard to efficiency	process
	percentage of teamstart meetings at which a rehabilitation specialist was present	process

Note. Per team, the indicators were divided over several or all of the following main objectives: effectiveness, efficiency, expertise and customer satisfaction.

Summary

Traditionally, when introducing feedback interventions, the focus of performance indicators used as the basis for feedback has mainly been on the final results of tasks. This stemmed from the general contention that providing employees with information about their performance on the final results of their work unconditionally increases their performance. Only over the last few decades have researchers come to realize that findings regarding feedback effectiveness have not been consistent. More recent research has already suggested that several characteristics of feedback and task might act as significant moderators. However, until now, these moderating conditions remained poorly understood. The research reported in this dissertation aimed to contribute to the understanding of feedback effectiveness and examined the until now underexplored combined moderating effect of task uncertainty, type of feedback (outcome versus process feedback) and feedback reflection on feedback effectiveness. The main research question, '*Dependent on the level of task uncertainty, what type of feedback should employees be provided with for feedback to be effective?*', was addressed in three separate, yet closely related studies. In all studies, the well-validated ProMES method (Productivity Measurement and Enhancement System) was used for the development and provision of performance feedback.

In the first study (Chapter 2), a meta-analysis, the combined moderating effect of task uncertainty, type of feedback, and feedback reflection on the effectiveness of ProMES feedback was examined using performance data from 83 field studies from a wide variety of organizational settings. Results indicated that when task uncertainty is low, employees higher

on reflection on feedback outperform employees lower on reflection on feedback, irrespective of the type of feedback they receive. However, when task uncertainty is high, employees higher on reflection on feedback outperform employees lower on reflection on feedback when the proportion of process feedback is higher. Moreover, the reverse is true when the proportion of process feedback is lower. Thus, this study showed through meta-analysis over a large variety of tasks, teams, organizations, and industries that the effectiveness of feedback on performance is not at all straightforward. Task uncertainty, type of feedback, and reflection on feedback appear to be important moderating conditions for feedback effectiveness, where some combinations of these variables can lead to very large positive effects and others can actually lead to negative effects on performance.

In the second study (Chapter 3), a quasi-field experiment, it was examined whether task uncertainty influences the type of performance indicators participatively developed by practitioners from the field. For this purpose, a task uncertainty framework was defined. Then, 50 care providing employees divided over 8 medical rehabilitation teams varying on task uncertainty participated in the development of performance feedback systems using the ProMES method. Results indicated that teams higher on task uncertainty develop relatively more process indicators (compared to outcome indicators) than teams lower on task uncertainty. Moreover, in line with the task uncertainty framework, process indicators developed by teams higher on task uncertainty are more of a problem solving nature, whereas process indicators developed by teams lower on task uncertainty are more of a procedural nature. Thus, this study showed through quasi-field research in health care that the level of uncertainty employees are dealing with during care provision determines which types of indicators are regarded as helpful with the successful fulfillment of their tasks.

In the third study (Chapter 4), a quasi-field experiment, it was examined whether task uncertainty, type of feedback, and feedback reflection have a moderating effect on performance with the sequential introduction of outcome and process feedback. For this purpose, 107 care providing employees, belonging to 4 medical rehabilitation teams varying on task uncertainty, periodically received performance feedback through ProMES feedback reports, which were discussed in feedback meetings. Results indicated that a three-way interaction exists between the level of task uncertainty, the type of feedback, and the time spent on reflection on feedback during feedback meetings, such that only with higher levels of task uncertainty and higher levels of reflection process feedback results in higher performance than outcome feedback. In addition, longitudinal questionnaire data from a repeated measures design with three time waves were used in this study to examine the

combined effect of task uncertainty and type of feedback on factors enabling the development and use of task knowledge, such as coping with task uncertainty, task information sharing, role clarity, and empowerment. The results indicated that with higher levels of task uncertainty, only the introduction of process feedback (compared to outcome feedback) has a positive effect on these supposedly performance-enhancing factors. Thus, this study showed through a quasi-field experiment in health care that the effectiveness of feedback is dependent on the level of task uncertainty, the type of feedback, and the level of reflection on feedback. Through reflection on process feedback, employees dealing with higher levels of task uncertainty are presented with the opportunity to develop and use appropriate task knowledge.

In conclusion, the research presented in this dissertation confirmed through meta-analysis and empirical field research that the effects of feedback are not always the same. Instead, moderating conditions such as task uncertainty, type of feedback, and reflection on feedback play important roles in the effects of feedback, both on performance and on underlying psychological factors such as coping with task uncertainty, task information sharing, role clarity, and empowerment. Ignoring these findings when designing and implementing performance feedback systems could be harmful for organizations.

Samenvatting

(Summary in Dutch)

Tot op heden heeft bij het introduceren van feedback interventies de focus van prestatie-indicatoren, gebruikt als de basis voor feedback, met name gelegen bij de eindresultaten van taken. Dit stamt van de algemene opvatting dat het bieden van informatie aan medewerkers over de prestaties op de eindresultaten van hun werk onvoorwaardelijk zorgt voor een toename van de prestaties. Pas in de laatste decennia zijn onderzoekers meer en meer tot het besef gekomen dat eerdere bevindingen met betrekking tot de effecten van feedback niet consistent zijn geweest. Meer recentelijk onderzoek heeft al gesuggereerd dat verscheidene eigenschappen van zowel feedback als taak als belangrijke moderatoren zouden kunnen optreden. Echter zijn tot nu toe dergelijke modererende condities slecht begrepen gebleven. Het onderzoek dat gerapporteerd wordt in de huidige dissertatie had tot doel om een bijdrage te leveren aan het begrip van de effectiviteit van feedback. Hierbij werd het gecombineerde modererende effect van taakonzekerheid, type feedback (resultaat versus proces feedback) en feedback reflectie op feedback effectiviteit onderzocht; tot nu toe weinig bestudeerde variabelen. De bijbehorende, belangrijkste onderzoeksvraag, '*Afhankelijk van het niveau van taakonzekerheid, wat voor type feedback dient gegeven te worden aan medewerkers om feedback effectief te laten zijn?*', werd aan de orde gesteld in drie verschillende, maar sterk gerelateerde studies. In alle studies werd de gevalideerde ProMES methode (Productivity Measurement and Enhancement System) gebruikt voor de ontwikkeling en levering van feedback.

In de eerste studie (Hoofdstuk 2), een meta-analyse, werd het gecombineerde modererende effect van taakonzekerheid (*task uncertainty*), type feedback (*type of feedback*) en feedback reflectie (*reflection on feedback*) op de effectiviteit van ProMES feedback onderzocht door gebruik te maken van 83 veldstudies met een grote verscheidenheid in organisatorische omgevingen. De resultaten duidden erop dat bij lage taakonzekerheid medewerkers met een hogere mate van reflectie op feedback beter presteren dan medewerkers met een lagere mate van reflectie op feedback, ongeacht het type feedback dat zij ontvangen. Echter, bij hoge taakonzekerheid presteren medewerkers met een hogere mate van reflectie op feedback beter dan medewerkers met een lagere mate van reflectie naarmate de proportie proces feedback in de totale set prestatie-indicatoren groter is. Bovendien geldt het tegenovergestelde wanneer de proportie proces feedback kleiner is. Dus, deze studie heeft middels meta-analyse over veel verschillende taken, teams, organisaties en bedrijfstakken aangetoond dat de effectiviteit van feedback op de prestaties geheel niet eenduidig is. Taakonzekerheid, type feedback en reflectie op feedback blijken belangrijke modererende condities te zijn voor feedback effectiviteit, waarbij sommige combinaties van deze variabelen kunnen leiden tot erg grote positieve effecten en andere combinaties zelfs kunnen leiden tot negatieve effecten op de prestaties.

In de tweede studie (Hoofdstuk 3), een quasi-experimenteel veldonderzoek, werd onderzocht of taakonzekerheid invloed heeft op het type prestatie-indicatoren dat participatief ontwikkeld wordt door medewerkers vanuit de praktijk. Voor dit doel werd een taakonzekerheid raamwerk gedefinieerd, waarna 50 medewerkers uit de zorg, verdeeld over 8 revalidatieteams variërend in de mate van taakonzekerheid, deelnamen aan de ontwikkeling van feedback systemen door middel van de ProMES methode. De resultaten duidden erop dat teams hoger op taakonzekerheid relatief meer proces indicatoren ontwikkelen (vergeleken met resultaat indicatoren) dan teams lager op taakonzekerheid. Bovendien blijken, in overeenstemming met het taakonzekerheid raamwerk, proces indicatoren ontwikkeld door teams hoger op taakonzekerheid meer van een probleemoplossende aard, en proces indicatoren ontwikkeld door teams lager op taakonzekerheid meer van een procedurele aard te zijn. Dus, deze studie heeft middels quasi-experimenteel veldonderzoek in de gezondheidszorg aangetoond dat het niveau van taakonzekerheid waar medewerkers mee te maken hebben bij het bieden van zorg bepalend is voor het type prestatie-indicatoren dat als nuttig wordt beschouwd voor de succesvolle voltooiing van hun taken.

In de derde studie (Hoofdstuk 4), een quasi-experimenteel veldonderzoek, werd onderzocht of taakonzekerheid, type feedback en feedback reflectie een modererend effect

hebben op de prestaties bij de sequentiële introductie van resultaat- en proces feedback. Voor dit doel ontvingen 107 medewerkers uit de zorg, behorende bij 4 revalidatieteams variërend in de mate van taakonzekerheid, periodiek feedback door middel van ProMES feedback rapporten, welke werden besproken tijdens feedback bijeenkomsten. De resultaten duidden erop dat er een 3-weg interactie bestaat tussen het niveau van taakonzekerheid, het type feedback en de tijd besteed aan reflectie op feedback gedurende de feedback bijeenkomsten, zodat proces feedback enkel bij een hoger niveau van taakonzekerheid en een hogere mate van reflectie resulteert in hogere prestaties dan resultaat feedback. Additioneel zijn in deze studie longitudinale gegevens verzameld middels vragenlijsten in een onderzoeksontwerp met drie herhaalde metingen, om onderzoek te doen naar het gecombineerde effect van taakonzekerheid en type feedback op factoren die de ontwikkeling en het gebruik van taakkennis mogelijk maken, zoals het omgaan met taakonzekerheid (*coping with task uncertainty*), het delen van taakinformatie (*task information sharing*), het hebben van inzicht in taakfuncties (*role clarity*) en het in staat gesteld zijn een taak uit te voeren (*empowerment*). De resultaten duidden erop dat bij hoge taakonzekerheid enkel de introductie van proces feedback (in tegenstelling tot resultaat feedback) een positief effect heeft op deze vermoedelijk prestatie-verhogende factoren. Dus, deze studie heeft middels quasi-experimenteel veldonderzoek in de gezondheidszorg aangetoond dat de effectiviteit van feedback afhangt van het niveau van taakonzekerheid, het type feedback en de mate van de reflectie op feedback. Middels reflectie op proces feedback krijgen medewerkers die te maken hebben met hogere niveaus van taakonzekerheid de mogelijkheid om geschikte taakkennis te ontwikkelen en te gebruiken.

Concluderend heeft het onderzoek dat gepresenteerd werd in deze dissertatie bevestigd middels meta-analyse en empirisch veldonderzoek dat de effecten van feedback niet altijd hetzelfde zijn. In plaats daarvan blijken modererende condities, zoals taakonzekerheid, type feedback en reflectie op feedback, een belangrijke rol te spelen in de effecten van feedback, zowel op de prestaties, als op onderliggende psychologische factoren zoals het omgaan met taakonzekerheid, het delen van taakinformatie, het hebben van inzicht in taakfuncties en het in staat gesteld zijn een taak uit te voeren. Het negeren van deze bevindingen bij het ontwerpen en implementeren van feedback systemen kan nadelige gevolgen hebben voor organisaties.

About the Author

Eric van der Geer - Rutten - Rijswijk was born on June 8th, 1980 in Waalre in The Netherlands. He obtained his Master's degree in Industrial Engineering and Management Science at Eindhoven University of Technology in 2004. His highly-valued graduation research on human performance management covered the measurement of the quality of service behaviors. The current dissertation is the result of his follow-up PhD research in the field of work and organizational psychology on task uncertainty as a moderator for feedback effectiveness, started in April 2004 at the department of Technology Management at Eindhoven University of Technology. His main research interests include performance management, feedback, reflection, and task uncertainty.