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THE EFFECTS OF FREQUENCY OF FEEDBACK ON PERCEPTIONS OF CONTROL

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THE EFFECTS OF FREQUENCY OF FEEDBACK ON PERCEPTIONS OF CONTROL

By

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ABSTRACT

THE EFFECTS OF FREQUENCY OF FEEDBACK ON PERCEPTIONS OF CONTROL

By

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The presence of some type of feedback appears to be necessary in order for performance on most types of tasks to increase (Ammons, 1956). This increase in performance has usually been attributed to the informational and/or motivational effects of the feedback message. Recently, Ilgen, Fisher, and Taylor (1979) have suggested that feedback might also impact on the feedback recipient's perceptions of control. A laboratory study was conducted in order to examine the effects of increasing levels of frequency of feedback on participants' perceptions of external and personal control and on task performance and satisfaction with the task. Results were supportive of the hypothesis that frequency of feedback has a direct effect on feedback recipients' perceptions of control. Perception of personal control was positively related to task performance and satisfaction with the task. Perception of external control was not significantly related to task performance and/or intrinsic task satisfaction.

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INTRODUCTION

The concept of feedback has become something of a generic term within the field of industrial/organizational psychology. In general, feedback has typically been defined as information provided by some source to a recipient that pertains to the effectiveness of the recipient's behavior in a given situation (Taylor & Walther, 1981). The information may be transmitted to the recipient either during the time in which the behavior is occurring or after the behavior has ended (I.M. Bilodeau, 1966).

A recent review of the literature on feedback by Ilgen, Fisher, and Taylor (1979) has served to highlight the complexity of this seemingly simple concept. Changes in behavior which result from a given feedback message may be the outcome of several different processes. The present research presents a more complex view of the feedback concept in order to lead to testable hypotheses about the impact of feedback on process and outcome variables.

The paper will begin by examining the relationship between feedback and performance and the process variables that have been suggested by previous researchers in order to explain this relationship.

Conceptual Models of the Feedback Process

The feedback model. Feedback has been of interest to researchers in industrial/organizational psychology because, in general, it has been found to have a positive relationship with performance (Ammons, 1956; Annett, 1969; I.M. Bilodeau, 1966; Cook, 1968; Cummings, Schwab, & Rosen, 1971; Hackman & Lawler, 1971; Hackman & Oldham, 1976; Hundel, 1969; Ilgen et al., 1979; Locke, Shaw, Saari, & Latham, 1981; Vroom, 1969). This positive relationship between feedback and performance has usually been explained by the unmeasured assumption that the feedback message had served either an informational or motivational function for the recipient (Ammons, 1956; Annett & Kay, 1957; I.M. Bilodeau, 1966; Deci, 1975; Ilgen et al., 1979; Locke, Cartledge, & Koeppel, 1968). A model of the feedback process based on this perspective is presented as Figure 1.

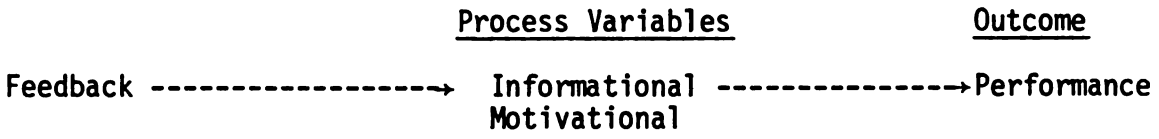

Figure 1. A model of the feedback process

The feedback message, through its informational process, serves to inform the recipient as to either what has been accomplished by past behavior or informs the recipient about the extent/direction of error in past performance (I.M. Bilodeau, 1966; Ilgen et al., 1979; Locke et al., 1968). The feedback message may also affect performance through a motivational process in that the feedback message may

increase the amount of persistence and effort displayed by the recipient on the task (Ammons, 1956; I.M. Bilodeau, 1966; Deci, 1975).

The feedback model presented in Figure 1 has a great deal of appeal as a simple heuristic of feedback and its effects. However, the model is, at best, an incomplete explanation of the feedback concept, its impact on the process variables, and the effects of feedback on various outcomes. Two points illustrate the deficiency of the model. First, the model in Figure 1 treats feedback as a unidimensional concept. Several researchers have suggested that feedback is, in actuality, a multi-dimensional concept (e.g., I.M. Bilodeau, 1966; Ilgen et al., 1979; Wroten, 1979a). Different feedback dimensions may have the same or different effects on the informational or motivational process variables. Second, a change in task performance is not the only outcome that might potentially result from a given feedback message (Deci, 1975; Ilgen et al., 1979). For example, a change in the recipient's self-concept would be another outcome that might come about as a result of the contents of a feedback message (Ashford & Cummings, 1984).

At the operational level, there has been a tendency among previous researchers to simply attribute increases in performance to the informational and motivational process variables without measuring these variables in some manner. In other words, the informational and motivational process variables are assumed to be present only after the researcher has found a positive relationship between feedback and performance.

The deficiencies of the model in Figure 1 serve to illustrate the need for a more complete model of the feedback process. For the present research, a more complete model is developed within the framework of the more traditional model presented in Figure 1.

An updated model. The first deficiency of the traditional model of the feedback process is that it treats feedback as a unidimensional variable. However, feedback appears to be a multidimensional variable (Bourne, 1966; Ilgen et al., 1979; Wroten, 1979b). For example, research by Wroten (1979b) has yielded at least eight possible dimensions of feedback. Wroten's dimensions and a brief explanation of each are presented in Table 1.

Wroten (1979b) has defined the comparativeness dimension of feedback as involving whether or not the behavior in the feedback message is described by comparing it to a standard of performance. The evaluativeness dimension (labeled as the "sign" dimension by Ilgen et al., 1979) refers to whether or not the feedback message is primarily positive or negative in nature. The degree to which the information given to the feedback recipient attempts to show how the task should be done in the future defines the prescriptiveness dimension of feedback. The feedback dimension of specificity involves the level of ambiguity of the information provided to the recipient. The accuracy of the feedback is simply a dimension which describes how closely the information given to the recipient reflects actual task performance. The quantity dimension involves how much information is given to a recipient at a single point in time. The delay between the time of a response and the presentation of information regarding the accuracy of that

Table 1

Dimensions of Feedback

Dimension	Explanation
Comparativeness	Is performance described by comparing it to a standard?
Evaluativeness (sign)	Is the comparison positive or negative?
Prescriptiveness	Does the information attempt to tell how the task should be performed in the future?
Specificity	Is the information specific, detailed and precise vs. being vague, ambiguous and general?
Accuracy	Is the information a true reflection of job performance?
Quantity	The amount of feedback given at any one time.
Immediacy (timing)	What is the time delay between task performance and the reception of performance feedback?
Frequency	Is the feedback constant and continuous vs. being occasional or nonexistent?

(based on Wroten, 1979b)

response defines the immediacy (Ilgen et al.'s "timing") dimension of feedback. Finally, frequency of feedback in Wroten's system involves how often a response is followed by information about the adequacy of that response. (See Bourne (1966) and Ilgen et al. (1979) for other potential dimensions of feedback.)

Wroten's dimensions of feedback allow for a clearer understanding of why two different feedback messages might have quite different implications for a given recipient. Understanding of the feedback process might also be increased by further expanding and measuring the number of process and outcome variables that result from the feedback message.

The concern of Ilgen et al. (1979) was that feedback has not always been found to result in increased performance (e.g., see Organ, 1977). Ilgen et al. were particularly concerned that treating feedback as a unidimensional variable was leading researchers to focus on a single type of outcome variable (performance) and on process variables that have been traditionally linked with attempts to increase performance in organizational settings. Instead, Ilgen et al. (1979) suggested that more attention should be paid to the perceptions of the feedback recipient and, in turn, how those perceptions impact on outcomes like performance and intrinsic motivation to perform a task.

Ilgen et al. (1979) and Deci (1975) have proposed that the recipient's perceptions of control should also be included as part of the feedback process. Deci (1975) places such perceptions of control at the level of process variables when he notes that all feedback has both an informational and a controlling function.

In other words, feedback serves not only to inform and motivate the recipient; it can also be perceived as an attempt by the feedback source to control the recipient's behavior. Research by Fisher (1978) supports the importance of an individual's perception of control. She found that perception of personal control over performance was an important antecedent to an individual's intrinsic motivation to perform a task. Moreover, Fisher reported that if either performance or perception of personal control over that performance were not high, subjects were not intrinsically motivated to perform the task.

A related deficiency of the traditional model of the feedback process has been the heavy use of task performance as the only outcome variable in feedback research. While task performance is always an important outcome variable, the inclusion of perceptions of control as a process variable strengthens the need for research utilizing additional outcome variables (as in Fisher's, 1978, study described above). For example, outcome variables such as task satisfaction (Cook, 1968; Mossholder, 1980), instrinsic motivation (Arnold, 1976; Deci & Ryan, 1980; Fisher, 1978) and noncompliance behavior (Organ, 1977) have all been linked in previous research to changes in perceptions of control.

An updated feedback model is presented as Figure 2. This updated model retains the same basic configuration of the major variables as the traditional model in Figure 1, but also adds needed complexity by including dimensions of feedback, perceptions of control as an additional process variable, and a list of potential outcome variables. In addition to being a more complete

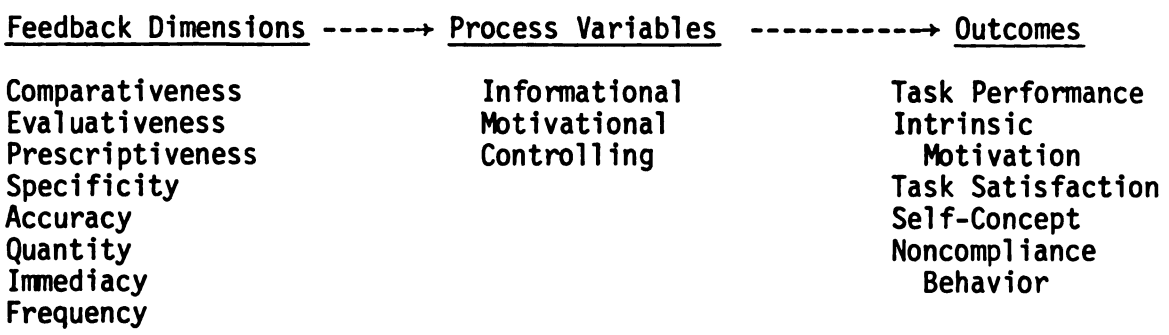

Figure 2. An updated model of the feedback process

representation of the feedback construct and its possible effects, the updated model in Figure 2 also serves as an aid in generating testable hypotheses to increase our understanding of how feedback impacts on a recipient. For example, one might manipulate a single dimension of feedback in order to find out how changes in that dimension affect both the process variables and selected outcome variables. As an illustration, a study by Cook (1968) examined the effects of frequency of feedback on performance and recipients' interest and satisfaction with a business simulation game. Both performance and recipients' attitudes toward the simulation were positively related to the frequency with which they were given performance feedback. Unfortunately, this study provides only a limited test of the updated model because Cook made no attempt to measure the informational, motivational or controlling aspects of the feedback that was provided. The present study builds on the work of Fisher (1978), Cook (1968), and Ilgen et al. (1979) to examine the impact of frequency of feedback on perceptions of control, task performance and task satisfaction.

Frequency and Control

There are a large number of studies which could potentially be performed in order to examine the updated model of the feedback process. The simplest type of study would be one which attempted to limit its scope to a single dimension of feedback and a single process variable. The types of outcome variables measured in such a study would be determined, in part, by the process variable that was of interest.

The process variable of perception of control was chosen as the basis for an exploratory study of the updated model of the feedback process. This variable was chosen for several reasons. First, perception of control is the newest process variable to be added to the model and, therefore, there is still some doubt as to whether or not such perceptions are affected at all by feedback messages (Ilgen et al., 1979). Second, Ilgen et al. (1979) have provided an a priori rationale for linking a specific dimension of feedback (frequency) with the process variable of perception of control. These researchers were concerned that increases in the frequency of feedback beyond a given level might result in increasing perceptions of external control on the part of the feedback recipient. Ilgen et al. (1979) reasoned that as frequency of feedback is increased, monitoring of the recipient's behavior might also have to be increased. Monitoring of behavior has been shown in past research to have an effect on perceptions of control and on intrinsic motivation (Deci & Ryan, 1980). However, if monitoring of behavior was held constant, would increases in the frequency of feedback level alone be enough to change recipients' perception of control? Related to this question would

be the issue of how such changes in perception of control might affect outcome variables like task performance and task satisfaction. These two issues were used as the basis for a study testing one part of the updated model of the feedback process.

Operational Problems

The benefits resulting from the added complexity of the updated model at the conceptual level are balanced, in part, by an increase in the potential number of problems at the operational level. There are a number of operational problems involved with the updated model in general and with the dimension of frequency of feedback in particular. First, while the dimensions of feedback can be separated at the conceptual level, they can be difficult to separate at the operational level. This appears to be especially true for the dimensions of frequency of feedback and immediacy of feedback. For example, Taylor and Walther (1981) reported a correlation of .73 between their measures of frequency and immediacy. It appears to be almost inevitable that as one increases the frequency with which feedback is given one will also increase the immediacy (i.e., decrease the time delay) of the feedback.

A similar operational problem is inherent in the process variables. Most feedback messages probably serve all three process functions (informing, motivating, and controlling). What is important is the relative salience of a given process variable (Deci, 1975). In the present study, perception of control was the process variable of interest. Therefore, some attempt would have to be made to control or minimize the informational and motivational effects of the feedback messages.

A third operational problem pertains to the perception of control variable. In general, researchers have discussed perceptions of control as either perception of personal control (e.g., Deci, 1975; Fisher, 1978) or as perception of external control (e.g., Ilgen et al., 1979). The nature of the relationship between perceptions of personal control and external control is not at all clear. For example, in their discussion, Ilgen et al. (1979) related frequency of feedback to "felt external control" (p. 366). However, Ilgen et al. also seemed to place perception of control on a single continuum such that any increase in perception of external control would also result in a decrease in perception of personal control. This confusion as to the nature of the relationship between personal control and external control suggests that measures of both variables merit inclusion in any exploratory study involving the effects of feedback on perceptions of control.

Another operational problem inherent in a study relating frequency to perception of control is that of determining the "desired" level of feedback frequency for the task. Ilgen et al. (1979) argued that frequency of feedback that was higher than a "given" level would result in an increased perception of external control on the part of the feedback recipient. This critical level of frequency is probably dependent upon the nature of the task. For most tasks, some amount of feedback is necessary in order to maintain performance (I.M. Bilodeau, 1966). White (1959) and Ashford and Cummings (1984) have both suggested that the desire for feedback should increase in situations where the task is unfamiliar or where outcomes are less than certain. Combining these two facts suggests

that for most tasks there exists a "natural" or a "desired" level for frequency of feedback. This "desired" level of frequency of feedback may vary from one task to another and across individuals.

Integration and Hypotheses

The general goal of the present study was to examine a series of hypotheses that were generated from the updated model of the feedback process presented in Figure 2. In order to control the scope of the present study, it was necessary to focus on a single dimension of feedback and a single type of process variable. Frequency of feedback and perception of control were chosen because previous theoretical and empirical work (in particular Ilgen et al., 1979) had indicated that the combination of these two variables might result in declines in task performance and workers' attitudes concerning the task. Therefore, the present study was focused on the linkages between frequency of feedback, perception of control (using measures of both personal and external control), task performance, and task satisfaction. Figure 3 presents a series of illustrations that serve as a guide to the hypothesized links between these variables.

The first hypothesized linkage is that between frequency of feedback and perception of control. As previously noted, there has been some ambiguity as to how one should operationalize perception of control (i.e., whether feedback frequency affects perception of personal control or external control). However, some amount of feedback seems to be necessary in order to maintain task performance (I.M. Bilodeau, 1966). It has therefore been argued that there is a "desired" or "natural" frequency of feedback level for any given

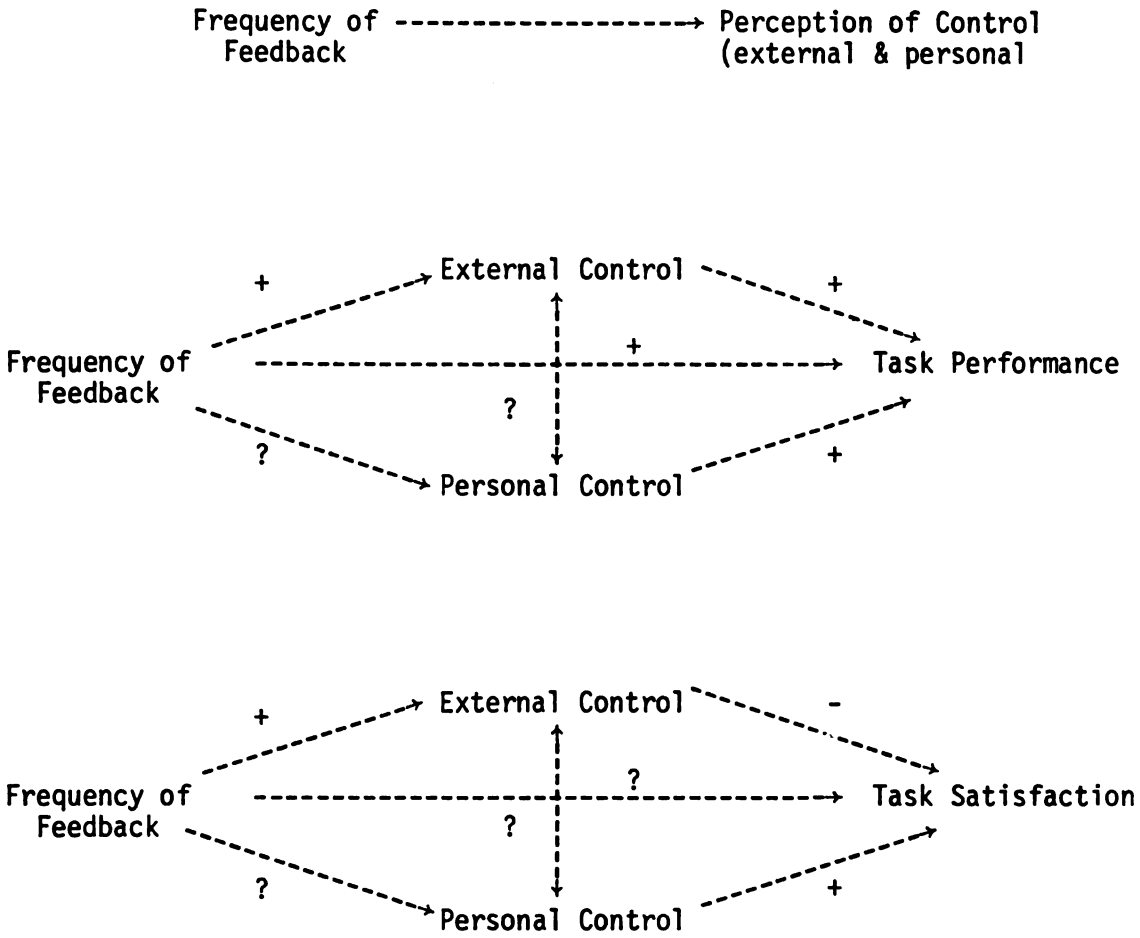

Figure 3. Anticipated effects of frequency of feedback on perception of control, task performance, and task satisfaction

task. Assuming that the content of the feedback message is generally positive in sign, one would not anticipate that feedback given at the "desired" level would negatively affect perception of control. Therefore, only feedback that is given above the "desired" frequency of feedback level for the task would be expected to alter such perceptions. The first hypothesis for the present study, therefore, was that:

> Hypothesis 1: Increasing the frequency of feedback beyond the desired level for a task will affect the feedback recipient's perceptions of control.

In particular, Ilgen et al. (1979) felt that increasing the frequency with which feedback was given would result in increasing perception of external control on the part of the feedback recipient. Therefore, a corollary to the first hypothesis would be that:

> Corollary A: Increasing the frequency of feedback beyond the desired level for a task will result in an increasing perception of external control on the part of the feedback recipient.

No logically consistent argument regarding the effect of frequency of feedback on perception of personal control can be made at this time. One could argue that if increasing the frequency of feedback level results in increased perception of external control, increased feedback frequency should also result in decreased perception of personal control. This line of argument is based on the assumption that personal control and external control are on opposite ends of

the same continuum or are, at the least, highly negatively correlated with one another. However, based on previous research, one could just as easily argue that increasing the frequency of feedback would result in increased perception of personal control on the part of the recipient. For example, Cook (1968), Ammons (1956), and others have consistently found that increasing feedback frequency has a positive effect on performance.

The relationship between frequency of feedback and perception of control would be inconsequential if there proved to be no relationship between these two variables and outcome variables such as task performance and task satisfaction. However, by including perception of control as a process variable between frequency of feedback and the outcome variables of performance and task satisfaction, one might anticipate that frequency of feedback would have different effects on these outcome variables. First, there would be the effect of increased feedback frequency on task performance. The positive relationship between feedback and performance has been well established in a large number of studies (e.g., Ammons, 1956; Bourne, 1966; Cook, 1968; Locke et al., 1981). Therefore, the second hypothesis is that:

> Hypothesis 2: Increasing the level of frequency of feedback will lead to an increase in performance on a task.

If one accepts the link between feedback frequency and perception of control from Hypothesis 1 but retains some doubt as to the nature of the relationship between perceptions of external control and

personal control, then performance might be expected to increase for either of two reasons. First, if feedback messages were perceived as externally controlling and recipients decided to comply, then one would expect to find a positive relationship between frequency of feedback, perception of external control, and performance (Organ, 1977). Such perceived pressure for compliance might be especially heavy in a psychological laboratory. Therefore, if the feedback recipient decided to comply with the perceived external attempts at control, one would find that:

> Hypothesis 3: Perception of external control will be positively related to task performance.

Fisher's (1978) results suggest a second reason why one might expect to consistently find a positive relationship between increased frequency of feedback and performance. Fisher (1978) reported in her study that perception of personal control was positively related to performance. If increasing frequency of feedback caused a decrease in perception of personal control, and perception of personal control was positively related to performance, then one would expect that more studies would report finding that increased frequency of feedback resulted in decreased performance. However, if one assumes that more frequent feedback may have a positive effect on perception of personal control, then performance increases from increased feedback frequency might be due to increased personal control over that performance. In any case, as far as the relationship between personal control and performance, Fisher's findings suggest that:

Hypothesis 4: Perception of personal control will be positively related to task performance.

The direction of the relationship between frequency of feedback, perception of control, and task satisfaction would be expected to be slightly different from that of task performance. Mossholder (1980) noted that intrinsic task satisfaction and intrinsic motivation have generally been measured in a similar manner and may be measures of the same construct. Increasing perceptions of external control and decreasing perceptions of personal control have been shown in past research to have a negative effect on intrinsic motivation (Deci, 1975; Deci & Ryan, 1980). If intrinsic motivation and task satisfaction are similar constructs, one would expect to find a negative relationship between perceptions of external control and task satisfaction. One would also expect to find a positive relationship between perceptions of personal control and task satisfaction. Therefore, if increasing frequency of feedback beyond the "desired" level changes the recipient's perceptions of control, one would expect to find that:

Hypothesis 5: The feedback recipient's perception of external control will be negatively related to his/her reported satisfaction with the task.

and

Hypothesis 6: The feedback recipient's perception of personal control will be positively related to his/her reported satisfaction with the task.

The direct effect of frequency of feedback on intrinsic task satisfaction is problematic. The effect would depend upon: (a) how frequency of feedback affects perception of personal control, and (b) the relative salience of the recipient's perceptions of external and personal control. Therefore, no formal hypothesis will be made regarding the effect of increased feedback frequency on intrinsic task satisfaction.

The six hypotheses derived from the relationships presented in Figure 3 formed the basis for a laboratory experiment which attempted to examine the effects of a single dimension of feedback (frequency) on the process variable of perception of control and on the outcome variables of performance and task satisfaction.

METHOD

Overview

There were a number of issues that needed to be resolved prior to the major experiment. First, a task had to be selected. Second, a preliminary study was required in order to measure the "natural" or "desired" level of feedback for the task. Third, it was necessary to establish how often the feedback recipients' perceptions of control could be measured without the effects of the repeated measurement process confounding the effects of different levels of frequency of feedback. In addition to these issues, there was also the need to work out some type of data-recording form that would enable the experimenter to give up-to-the-minute feedback to the recipient. To address these needs, two separate preliminary studies were conducted. The first study was used to examine the properties of the selected task, to develop a data-recording form, and to estimate the "desired" level of frequency of feedback for the task. The second preliminary study was conducted in order to measure the reactivity of the perception of control scales. The results of both of these preliminary studies were utilized in the major experiment which examined the effects of frequency of feedback on perceptions of control, task performance and intrinsic task satisfaction.

Subjects

A total of 110 subjects participated in the various stages of the experiment (8 in the first preliminary study; 25 in the second preliminary study; and 77 in the major experiment). The subjects were undergraduate students in introductory psychology courses at Michigan State University who received extra course credit in return for their participation. All of the subjects in the second preliminary study and in the major study were randomly assigned to an experimental condition.

Task

An adaptation of the Number Facility Task (Moran & Mefferd, 1959) was used in both of the preliminary studies and in the major experiment. The objective of the Number Facility Task is for the participant to correctly solve as many simple addition problems as he or she can within a given period of time. Task performance is measured by simply counting the total number of correct problem solutions.

There were a number of reasons for using the Number Facility Task in the present experiment. First, it was assumed that the need for feedback is higher when one is initially learning to perform a task than after one has mastered the skills involved in the task. The decision was made, therefore, to use a task for which the skills necessary were either already well learned or which would require a minimal amount of training. Presumably, the skills required in order to solve addition problems are already well-learned by most college-level students.

Second, the experiment required a task in which it would be difficult for the participant to monitor his or her own performance. Consequently, a task was needed that would result in a large amount of output within a relatively short period of time in order to make self-monitoring of performance more difficult for the participant.

Finally, the experiment required a task which could be repeated over a short period of time and which would be of an approximately constant level of difficulty for the participant. Because the problems within the Number Facility Task are randomly constructed, one could be relatively confident that the task was of about the same level of objective difficulty on the first trial as it was on the final trial.

General Procedures

The procedures used in both the preliminary studies and the major experiment were similar in nature. The major difference between the studies related to the "cover" story given to participants and to the independent variables that were of interest in the studies. In order to limit the amount of redundancy in explanation, a description of the general procedures used will be given here and any deviations from this procedure will be noted when describing the preliminary and major studies. A detailed outline of the procedures used in the major experiment is provided in a supplementary Appendix which appears at the end of this document (see Appendix D). Complete copies of the instructions, questionnaires, and data collection sheets are also reproduced in this Appendix.

Each participant was seated across a table from the experimenter. The experimenter began by telling participants in the preliminary studies that they would be participating in an experiment examining

the effects of fatigue on accuracy. The cover story was used during the preliminary studies in order to reinforce participants to focus on accurate problem solutions. No cover story was used during the major experiment.

The experimenter next proceeded to explain the nature of the task involved in the experiment. Subjects were told that the task involved in the experiment would require them to solve several sets of addition problems. These problems were written on 3 x 5 index cards and were arranged in eight sets labeled A through H. There were 99 addition problems in each set. Each subject was told that the objective in the experiment was to correctly answer as many of the addition problems within a given set as possible within a four minute time period. The subject was not allowed to make any marks on the index cards but was allowed to make any kind of mark desired on available scrap paper. The subject was also told that a single solution to each addition problem was to be written on one piece of this scrap paper and that the experimenter would be keeping track of the number of correct problem solutions. The subject was informed that the experimenter would be giving feedback about how he/she was doing from time to time during the course of the experiment.

After answering any questions regarding the procedures, subjects were asked to choose a letter between A and H. This served as a method of randomly selecting the first set of addition problems for each subject.

The experiment was divided into a discrete series of trials. The exact number of these trials was determined in the first preliminary study and was based on fatigue and time constraints.

Questionnaires containing the personal control and external control items were given following the completion of a trial. Exactly how often this type of questionnaire was given was determined in the second preliminary study. Subjects in the experiment were told that this type of questionnaire was attempting to measure their reaction to the set of addition problems which they had just completed.

A second questionnaire was given to each participant following completion of the final set of addition problems. This second questionnaire contained the task satisfaction items and the manipulation-check items for the experiment. Subjects were told that the purpose of this questionnaire was to elicit their reactions to the task as a whole. (Subjects in the first preliminary study were not asked to complete either the first or second type of questionnaire.)

While the subject was working on a set of addition problems, the experimenter kept track of the number of correct problem solutions using the answer key for the set of problems (A-H) in use. The experimenter also kept track of the amount of time that had passed in the trial and recorded the letter for the set of problems that were in use during a given trial. Initially, all data was recorded on an ordinary piece of notebook paper. For the major experiment, special data recording sheets were developed that mirrored the feedback condition for a given subject.

Preliminary Study I

Design

The principle reason for conducting the first preliminary study was to estimate the "desired" frequency of feedback level for the Number Facility Task. To do this, each subject was given what was called the "question" card. This was a 3 x 5 index card with a large question mark written on one side. The subject was instructed that feedback would be received whenever this index card was held up to the experimenter. The number of times that the participant actually used the "question" card during the course of the experiment was recorded by the experimenter and was used as an estimate of the "desired" level of frequency of feedback for the task.

Another goal of the first preliminary study was to establish how many sets of addition problems subjects could reasonably be asked to complete within approximately a forty-five minute time span. Therefore, the number of sets of problems which subjects completed was altered during the course of the study. The first several subjects were asked to work on four different sets of addition problems (i.e., 4 four-minute trials). This number was eventually increased to six sets of addition problems. While there was still some time available at this level, subjects reported that they were beginning to feel some fatigue after completing six sets of problems.

Upon completion of the final set of addition problems, the experimenter conducted an informal interview with the subject. The purpose of this interview was to debrief the subject and to elicit

subjective reactions to the task. The experimenter also asked subjects to make suggestions about how the experimental procedures might be improved.

Results

The main objective of the first preliminary study was to estimate the "desired" level of frequency of feedback for the Number Facility Task. This was measured by counting the number of times that the subject used the "question" card to request feedback from the experimenter. None of the eight subjects made use of the "question" card. In other words, none of the eight subjects in the first preliminary study requested verbal feedback from the experimenter during the course of any of the four-minute trials. Several participants verbally requested feedback after the completion of a given trial. Two persons, however, had received no feedback about their performance from the experimenter after completing three trials. Verbal feedback was automatically given to these participants following the third trial. The debriefing interviews conducted at the end of the experiment revealed that subjects did not want to be "distracted" by verbal feedback from the experimenter during the course of a trial. Based on this result, the desired level of frequency of feedback for the Number Facility Task appeared to be no greater than once per trial.

Several helpful suggestions for improving the experiment were made by participants during the course of the debriefing interviews. One subject suggested letting the participant choose which problem set he/she would work on for each trial during the experiment rather than for just the first trial. This suggestion was incorporated

into the experimental procedures for both the second preliminary study and for the major experiment. Another subject suggested that the experimenter record the number of incorrect problem solutions in addition to the number of correct problem solutions and that both numbers should be reported to the participant at the end of each trial. This suggestion was included in the procedures for the second preliminary study because the nature of the feedback message was not critical to the purposes of that study.

Preliminary Study II

Purpose

Individuals tend to seek feedback in unfamiliar situations (Ashford & Cummings, 1984). Conversely, this implies that an individual's desire for feedback from others will decrease as he or she becomes increasingly familiar with the nature of the task and the situation (Annett & Kay, 1957). Therefore, if frequency of feedback is positively related to perceptions of control, perceptions of control would be expected to change as experience with a task increased and frequency of feedback from others remained constant or increased. This line of reasoning made it necessary to measure participants' perceptions of control at several points during the course of the experiment in order to measure any changes in perceptions of control. The main objective of the second preliminary study was to examine whether there would be any side-effects of this use of repeated measurement on participants' perceptions of personal and external control.

Design

Frequency of feedback was not the variable of interest in the second preliminary study. Within each condition, feedback was given only at the end of each trial. This verbal feedback message from the experimenter contained information about the number of correct and incorrect problem solutions for a given trial. There were a total of six trials.

The independent variable in the second preliminary study was the number of times that a participant was asked to complete the questionnaire containing the personal control and external control items. There were five different conditions in the study. These conditions are illustrated in Table 2. Five subjects were randomly assigned to each condition.

Table 2

Experimental Design for Preliminary Study II

	Trial After Which Questionnaire was Given						
Condition	1	2	3	4	5	6	Total Presentations
1	X	X	X	X	X	X	6
2		X		X		X	3
3	X					X	2
4			X			X	2
5						X	1

The dependent variables in the study were the participants' perceptions of personal and external control. The items used to measure personal control and external control were adapted from

Fisher (1978). Of particular concern was whether participants' perceptions of personal and external control would be different following the sixth and final trial if the only manipulation involved in the study was the number of times that participants completed the questionnaire containing these items.

Procedures

The instructions and procedures used in the second preliminary study were similar to those described above in the section titled "General Procedures." The procedures differed from those used in the first preliminary study in that the "question" card and the part in the instructions concerning its use were eliminated. In addition to completing the questionnaire containing the personal control and external control items, a preliminary version of the task satisfaction scale was included on a final questionnaire. The items composing this scale were adapted from Mossholder (1980).

Results

Means and standard deviations for the person control scale are reported by condition in Table 3, while Table 4 presents these same results for the external control scale. Coefficient α for each scale are also included in the tables. Inspection of these results revealed almost no difference in the mean perceptions of the task, regardless of the number of times that participants completed the questionnaire. A one-way univariate analysis of variance reported no significant differences between conditions on perceptions of personal control ($F = 1.32$, NS) or external control ($F = 0.59$, NS) following the sixth trial. T-tests comparing conditions by the number of times the questionnaire had been completed (e.g., comparing

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Table 3

Means and Standard Deviations for the Personal Control Scale for Preliminary Study II

Experimental Condition	Trial 1	2	3	4	5	6
1	28.0 (4.5)	28.4 (3.9)	28.0 (4.5)	26.6 (5.8)	27.2 (4.0)	27.4 (4.0)
2		25.8 (4.3)		26.0 (2.8)		23.4 (6.0)
3	27.6 (3.9)					29.4 (5.3)
4			27.0 (2.0)			29.2 (3.3)
5						27.0 (4.5)

(Cronbach α = .741)

Table 4

Means and Standard Deviations for the External Control Scale for Preliminary Study II

Experimental Condition	Trial 1	2	3	4	5	6
1	12.0 (1.9)	10.2 (2.2)	11.4 (2.0)	12.2 (2.3)	10.6 (1.5)	9.0 (1.2)
2		12.2 (3.3)		10.6 (1.7)		11.6 (2.0)
3	10.4 (3.0)					9.6 (3.5)
4			8.0 (3.0)			8.4 (3.7)
5						9.6 (5.6)

(Cronbach α = .526)

conditions 1 and 2 following Trial 2) were also nonsignificant. The results also demonstrated the reliability of the personal control scale and indicated that there were reliability problems with some of the items in the external control scale.

Implications

It appeared that the number of times the participants were asked to fill out the questionnaire containing the personal control and external control items did not significantly affect subjects' perceptions of the task. Lacking a statistical basis for the decision on how often to give this type of questionnaire, the experimenter decided to use subjective criteria in order to make this decision. Therefore, the decision was made on the basis of: (a) the need for enough data points to be able to detect any potentially nonlinear changes in perceptions of control, (b) the experimenter's subjective impression of the length of time that subjects were taking to complete the questionnaire, and (c) the desire to match the pattern of changes of frequency of feedback planned for the major experiment. Based on these criteria, the decision was made to give the questionnaire containing the personal control and external control items three times, following the second, fourth, and sixth trials.

In light of their performance during the second preliminary study, several of the external control items were rewritten in order to improve the internal consistency of the external control scale.

Major Experiment

Design

There were a total of five conditions in the major experiment. A brief explanation of each of the five conditions is provided in Table 5. Based on the results of the first preliminary study, Condition #1 was to serve as a baseline condition. Participants in this condition were provided with verbal performance feedback at the end of each trial. Subjects in Condition #2 were given feedback at the middle (i.e., at the 2-minute mark) and at the end of each trial. Participants in Condition #3 were given verbal performance feedback each minute during the trial (including the end of the trial).

Conditions #4 and #5 involved changing levels of frequency of feedback. During the first two trials of Condition #4, feedback was provided only at the end of the trial. For the third and fourth trials of Condition #4, feedback was given at the middle (i.e., at the 2-minute mark) and at the end of the trial. Finally, during the fifth and sixth trials, feedback was provided to the participant during each minute of the trial. In Condition #5 the frequency of feedback level was essentially the reverse of that in Condition #4. In other words, verbal feedback on Condition #5 was provided at every minute during trials one and two, and decreased in frequency until it was being provided only at the end of trials five and six.

Independent Variable

The independent variable for the major experiment was the frequency of verbal performance feedback from the experimenter to the participant. For all experimental conditions, this feedback message consisted of the number of correct problem solutions within a given period of time.

Table 5

Explanation of Frequency of Feedback Conditions in the Major Experiment

Condition	Explanation
1	Feedback given only at the end of each trial (1X)
2	Feedback after two minutes and at the end of each trial (2X)
3	Feedback following the first, second, and third minutes and at the end of each trial (4X)
4	Feedback on trials 1 & 2 given at the end of the trial only; feedback on trials 3 & 4 given twice as in Condition 2; feedback on trials 5 & 6 given four times as in Condition 3 (increasing frequency condition)
5	The reverse of Condition 4; feedback given 4 times on trials 1 & 2, twice on trials 3 & 4, and once on trials 5 & 6 (decreasing frequency condition)

(based on 4-minute trials)

Subjects were not told the number of incorrect problem solutions in order to control for the evaluativeness of the feedback.

Dependent Variables

There were a total of four dependent variables in the major experiment. The first two dependent variables were the measures of personal and external control that were originally used in the second preliminary study. The items composing these scales are presented as Appendix A. These items appeared on the questionnaire that was completed by participants following the second, fourth, and sixth trials and were an adaptation of the personal and external control items used by Fisher (1978).

The third dependent variable in the major experiment was the participant's performance during the second, fourth, and sixth trials. Performance was operationalized as the number of addition problems solved correctly during a four minute trial. This measure of performance was consistent with how performance was being reported to participants during the task. Information on the number of errors per trial was also collected.

The fourth dependent variable in the major experiment was a scale designed to measure the subjects' intrinsic task satisfaction. The items in this scale were adapted from Mossholder (1980). These items were placed on a final questionnaire along with the manipulation-check items. The task satisfaction items are presented in Appendix B.

Method of Analysis

The data were analyzed in two stages. Because it was anticipated that the dependent variables in the major experiment would be intercorrelated, the first stage of the analyses consisted of a

multivariate analysis of variance (MANOVA) using a repeated measures design. The factors were feedback condition (5) by experimental trial (3). The dependent variables used in the MANOVA were the measures of personal control, external control, and performance. A univariate analysis of variance with one independent variable (feedback condition) was also conducted using the intrinsic task satisfaction measure as the dependent variable.

The second stage of the analyses were correlational analyses conducted to examine the relationship between the measures of personal and external control and the outcome variables of task performance and intrinsic task satisfaction. As a final step in this stage of analysis, several exploratory path analyses were performed in an attempt to provide tentative models of the causal relationships between these variables.

RESULTS

Overview

To test the hypotheses of the study, a number of analyses were conducted. In presenting the results, this section first examines the manipulation-check items. Next, reliability data for the scales measuring personal control, external control, and intrinsic task satisfaction and the inter-trial correlations for performance are presented followed by the means and standard deviations for the four dependent variables (personal control, external control, intrinsic task satisfaction, and performance). Results of the two types of analysis of variance (MANOVA and univariate ANOVAs) performed on the data are also presented. The results section concludes by reviewing the outcome of a correlational analysis and of several exploratory path analyses which were conducted in order to examine the relationship between the various dependent measures.

Manipulation Checks

Several types of manipulation-check items were included on the final questionnaire. The first type of manipulation-check item related to the "desired" level of frequency of feedback for the task. This "desired" level of feedback had been established as a result of the first preliminary study. However, due to the relatively small sample in the first preliminary study (N=8), it was thought that an item should be included in the major experiment in order to evaluate whether

or not the majority of individuals involved in the study concurred with this "desired" level of frequency of feedback for this type of task. If there was a wide range of response to this item, its inclusion would also allow us to examine whether or not the spread was relatively evenly distributed across the experimental conditions. The item asked participants to respond to the following question: "If I had to choose, the best rate at which I would have been given feedback about my performance would have been..." The possible responses included: (a) at the end of the experiment only, (b) after each problem set, (c) at the middle and at the end of each problem set, (d) several times during the problem set, and (e) other (please explain). The results from this manipulation-check item are presented in Table 6. As can be seen from the data in Table 6, almost 50% of those involved in the experiment would have preferred to have received feedback only at the end of each trial. If one combines the "end of experiment only" and the "end of trial" categories, then 74% of the subjects involved in the experiment would have preferred what might be called a "minimal" feedback condition. Only three of the 77 participants involved in the experiment reported that they wanted to receive feedback at "several times" during each trial. In general, these results are supportive of the use of feedback at the end of each trial as the baseline frequency of feedback condition for the task. Because this measure of subjects' "desired" level of feedback occurred after the experimental manipulation, a χ^2 analysis was conducted in order to determine whether the "desired" level of frequency of feedback reported by subjects might not simply be a

Table 6

Participants' Reports of Their Desired Frequency of Feedback Level

Would prefer to receive feedback:	Experimental Condition 1	2	3	4	5	Total
End of experiment only	3	5	4	4	4	20
After each trial	12	4	6	8	7	37
At the middle and end	1	5	5	3	3	17
Several times during each trial	0	1	1	0	1	3

function of their experimental condition. The relationship between "desired" frequency of feedback level and frequency of feedback condition was not significant (χ^2 = 10.33, NS).

The other manipulation-check items attempted to measure participants' perceptions of the frequency of feedback level within their experimental condition. One item asked the participant to simply check whether the frequency with which performance feedback was given during the sixth trial occurred less often, more often, or at the same rate as during the first trial. Of the 77 persons involved in the experiment, 88.3% identified the correct solution for their experimental condition.

A second type of manipulation-check for perceived frequency of feedback level was made up of two open-ended items. The first item asked the participant, "How often were you given information about your performance on the first problem set?" The second item asked the participant to answer the same question regarding the sixth problem set. Two criteria were used in analyzing the results from these

items. The first criterion required that the participant correctly identify the exact number of times that he/she had been given performance feedback during both the first and the sixth trials. Using this strict criterion, 74% of the subjects involved in the major experiment correctly identified the number of feedback messages that they had been given during both trials. The second criterion was less restrictive in that it only required that subjects' answers on the two items reflect the correct direction of any changes that had occurred in the frequency of feedback level or be within one of the correct number of messages (e.g., persons in Condition #3 who received feedback four times were counted correct if they answered three to both items). Using this less restrictive criterion, 90.9% of those involved in the experiment were able to correctly identify their frequency of feedback condition.

Based on the results from this second type of manipulation-check, it appears that most of the participants in the experiment accurately perceived the frequency with which feedback was given to them by the experimenter.

Reliability

Prior to conducting the reliability analyses, an important measurement issue had to be addressed. This issue concerned the nature of the relationship between the external control items and the items designed to measure perception of personal control. Previous researchers have been less than clear on the nature of this relationship. For example, Ilgen et al. (1979) seemed to imply that personal control and external control represented opposite ends of the same criterion. Therefore, a factor analysis with an oblique rotation

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was performed using all of the available questionnaires (N=231) containing the personal control and external control items. The factor analysis yielded three potential factors. (The factor loadings and eigenvalues from the factor analysis are presented in Appendix C.) The items composing the first two of these factors generally corresponded to the items that were written for the personal and external control scales. However, two of the five items which made up the external control scale split off into a third factor. The nature of this third factor was not clear and had very low internal consistency and was therefore dropped from further analyses. The results of the factor analysis provided some support for the inclusion of the measures of personal control and external control as separate dimensions of control.

Performance of the task was measured by the total number of correct problem solutions for a given trial. Table 7 presents the inter-correlations for performance across all six trials for all subjects. Inspection of these correlations shows that performance was relatively consistent from one trial to the next.

The items comprising the measures of personal control and external control were included on the questionnaire that participants completed following the second, fourth, and sixth trails. Test-retest data were therefore available for these scales in addition to internal consistency data. The resulting reliability data for the personal control scale are presented in Table 8. The numbers appearing in the diagonal of Table 8 represent the internal consistency (Cronbach α) of the personal control scale for a given measurement point. As can be

Table 7

Intercorrelations of Performance Across Trials

Trial	1	2	3	4	5	6
1	-					
2	.92	-				
3	.86	.90	-			
4	.88	.92	.93	-		
5	.81	.86	.89	.91	-	
6	.80	.86	.89	.88	.93	-

Table 8

Reliability Data for the Personal Control Scale

Trial[a]	2	4	6
2	.74[b]		
4	.72	.82	
6	.64	.76	.86

a = Measurement occurred following trials 2, 4, and 6.

b = Values in diagonal are Cronbach α's.

seen in the Table, the internal consistency of the personal control measure increased with repeated presentations. The mean internal consistency for the personal control scale was .807. The off-diagonal numbers in Table 8 represent the test-retest correlations for the measure of personal control. These correlations indicate that there may have been some change in participants' perceptions of personal control as experience with the task increased. The mean test-retest correlation for the personal control measure was .71.

The reliability data for the external control scale are presented in Table 9. As demonstrated in Table 9, the measure of external control was not as consistent (both internally and over repeated measurements) as the measure of personal control. Two of the items comprising the external control scale were deleted because they failed to intercorrelate with the other three items in the scale. The mean internal consistency of the shortened external control scale was only .45. The mean test-retest reliability of the external control measure was .62.

Table 9

Reliability Data for the External Control Scale

Trial[a]	2	4	6
2	.31[b]		
4	.62	.49	
6	.58	.67	.56

a = Measurement occurred following trials 2, 4, and 6.

b = Values in diagonal are Cronbach α's.

Intrinsic task satisfaction was measured using six items that appeared on the final questionnaire. As a result, intrinsic task satisfaction was measured only once. The internal consistency (Cronbach α) of the measure of intrinsic task satisfaction was .77.

Means and Standard Deviations

Means and standard deviations for the four dependent variables are presented below. The mean performance results for the five experimental conditions are presented in Table 10. In general, performance appeared to steadily improve across the six trials in most of the experimental conditions. The only exception to this generalization was the performance of the individuals in Condition #5 (decreasing frequency of feedback) whose average performance decreased on the sixth and final trial. The mean performance results are presented graphically in Figure 4. As can be seen in Figure 4, mean performance on the sixth trial was lowest in Condition #5 (28.73 correct problem solutions) and highest in Condition #2 (36.53 correct problem solutions). As Figure 4 illustrates, there did appear to be a slight learning-effect with increasing experience on the task. T-tests comparing performance on the first trial with performance on the sixth trial were performed for each experimental condition in order to test for this learning effect. All of the resulting T-values were significant (see Table 11).

The means and standard deviations for the measure of personal control are presented in Table 12. In this table, an increasing numeric value indicates an increasing perception of personal control. These results are illustrated in Figure 5. Inspection of Figure 5 indicates that perceptions of personal control appeared to change

Table 10

Means and Standard Deviations for Performance Across Trials

Experimental Condition	Trial 1	2	3	4	5	6
1	29.13 (7.8)	31.06 (7.9)	31.81 (8.0)	32.13 (7.5)	32.88 (9.1)	33.88 (8.6)
2	30.00 (7.8)	31.00 (7.7)	34.00 (8.6)	34.67 (7.3)	35.13 (8.4)	36.53 (9.1)
3	28.06 (8.3)	31.00 (8.7)	31.88 (8.5)	32.13 (7.8)	32.13 (7.8)	34.00 (8.7)
4	29.20 (6.4)	31.13 (6.0)	32.27 (6.8)	33.13 (6.4)	33.73 (5.9)	34.07 (5.2)
5	23.13 (6.7)	25.87 (5.9)	27.73 (5.6)	28.80 (5.8)	29.33 (5.3)	28.73 (5.5)
Total Sample	27.92 (7.7)	30.04 (7.5)	31.55 (7.7)	32.17 (7.1)	32.64 (7.5)	33.46 (7.9)

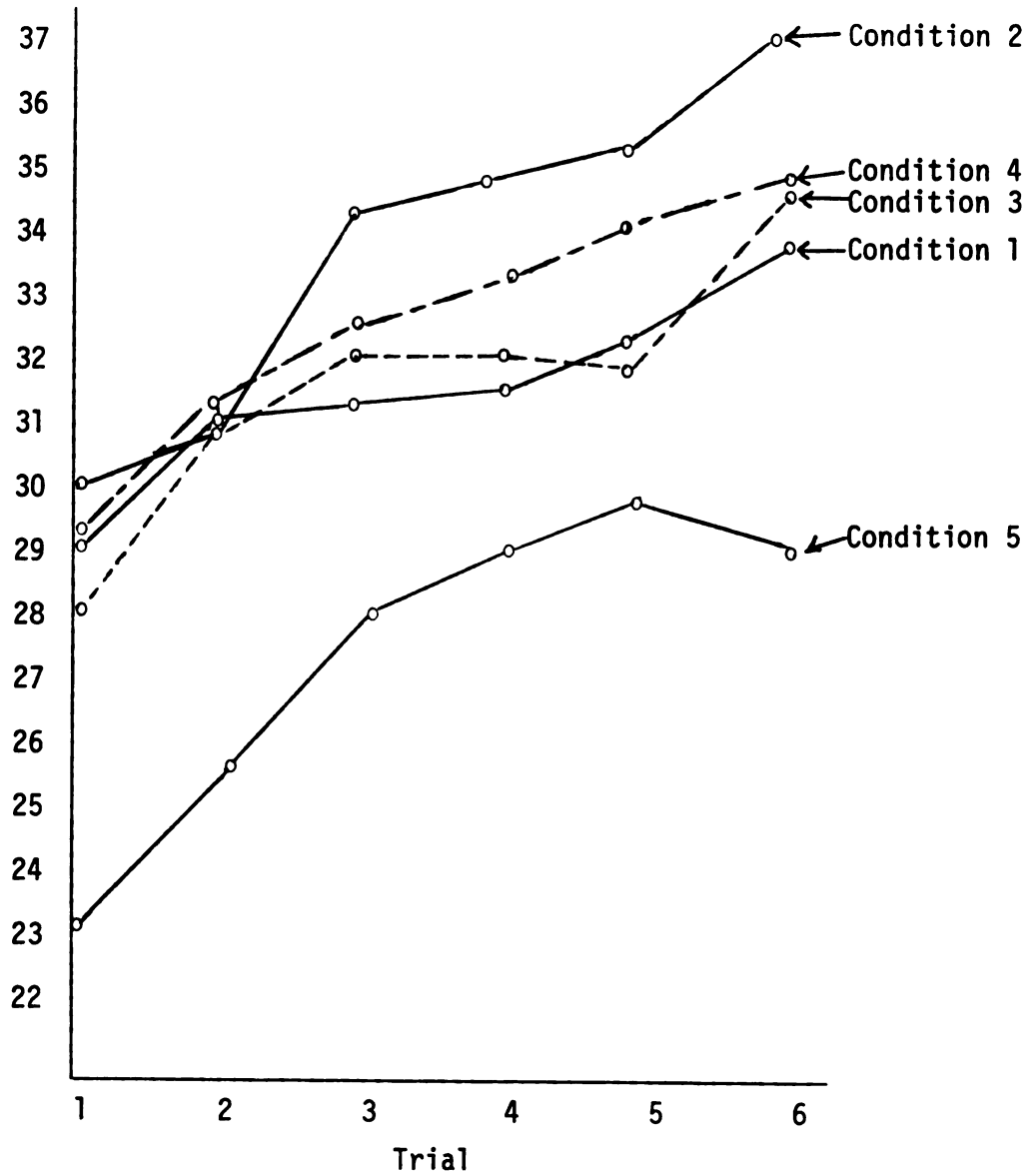


Figure 4. Mean performance by frequency of feedback condition across trials

Table 11

Results of T-tests for Learning Effect Across Feedback Conditions

Condition	N	Trial 6	Trial 1	T
1	16	33.88	29.13	3.13**
2	15	36.53	30.00	4.94***
3	16	34.00	28.06	5.49***
4	15	34.07	29.20	6.99***
5	15	28.73	23.13	3.31**
Total	77	33.46	27.92	9.83***

* $p < .05$

** $p < .01$

*** $p < .001$

Table 12

Means and Standard Deviations for the Personal Control Scale by Frequency of Feedback Condition

Experimental Condition	Trial 2	Trial 4	Trial 6
1	20.56 (5.2)	20.25 (5.0)	19.56 (6.6)
2	22.47 (3.1)	22.53 (2.9)	22.33 (3.9)
3	21.31 (2.6)	21.75 (4.2)	22.13 (3.5)
4	22.73 (3.2)	22.53 (3.7)	22.47 (3.1)
5	21.60 (4.1)	22.40 (2.4)	23.00 (2.2)
Total	21.74 (3.8)	21.87 (3.8)	21.87 (4.3)

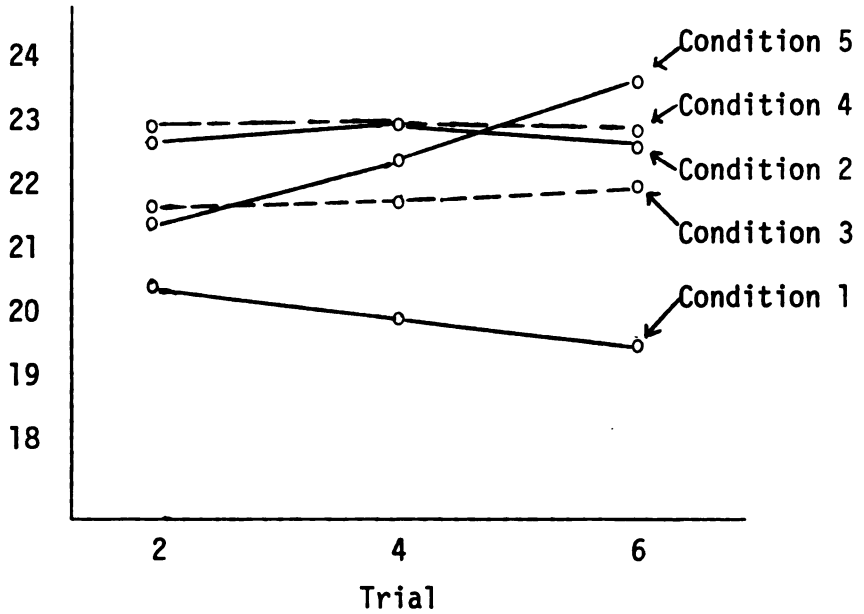


Figure 5. Mean perception of personal control by frequency of feedback condition

very little from the time of trial 2 to trial 6. Participants in Condition #5 (decreasing frequency of feedback condition) reported perceiving the greatest amount of personal control following the sixth trial (23.0) and participants in Condition #1 (feedback at the end of the trial only) on the average perceived that they had the least amount of personal control (19.6). Only the persons in Condition #1 appeared to differ from the other conditions in their perceptions of personal control.

The means and standard deviations for the external control scale are presented in Table 13 and are presented graphically in Figure 6. Again, an increasing number in Table 13 indicates an increasing perception of external control. Following the sixth trial, mean perceptions of external control were greatest in Condition #5 (13.0; decreasing frequency condition) and least in Condition #1 (8.81; feedback at the end of the trial only). Inspection of Figure 6 reveals that only participants in Condition #1 appeared to differ to any significant extent in their perceptions of external control.

Perceptions of intrinsic task satisfaction were measured by items on the final questionnaire given at the end of the experiment. The resulting means and standard deviations for each experimental condition are presented in Table 14. Once again, increasing satisfaction with the task is indicated by an increasing numeric value in Table 14. On the average, subjects in Condition #2 (feedback at the middle and end of each trial) reported feeling the greatest amount of satisfaction with the task ($\bar{X}$ = 30.0). Persons

Table 13

Means and Standard Deviations for the External Control Scale by Frequency of Feedback Condition

Experimental Condition	Trial 2	Trial 4	Trial 6
1	8.44 (3.1)	9.63 (3.8)	8.81 (2.9)
2	12.93 (2.1)	12.80 (2.5)	12.73 (3.5)
3	12.69 (3.2)	11.75 (3.8)	12.25 (4.0)
4	11.13 (2.9)	12.07 (2.6)	12.07 (3.2)
5	11.73 (4.1)	12.40 (3.5)	13.00 (4.2)
Total	11.36 (3.5)	11.70 (3.4)	11.74 (3.8)

Table 14

Means and Standard Deviations for Intrinsic Task Satisfaction Scale by Frequency of Feedback Condition

	Experimental Condition 1	2	3	4	5	Total
$\bar{X}$	27.19	30.00	28.06	29.13	28.73	28.60
S.D.	(5.9)	(5.5)	(4.9)	(5.8)	(4.2)	(5.2)

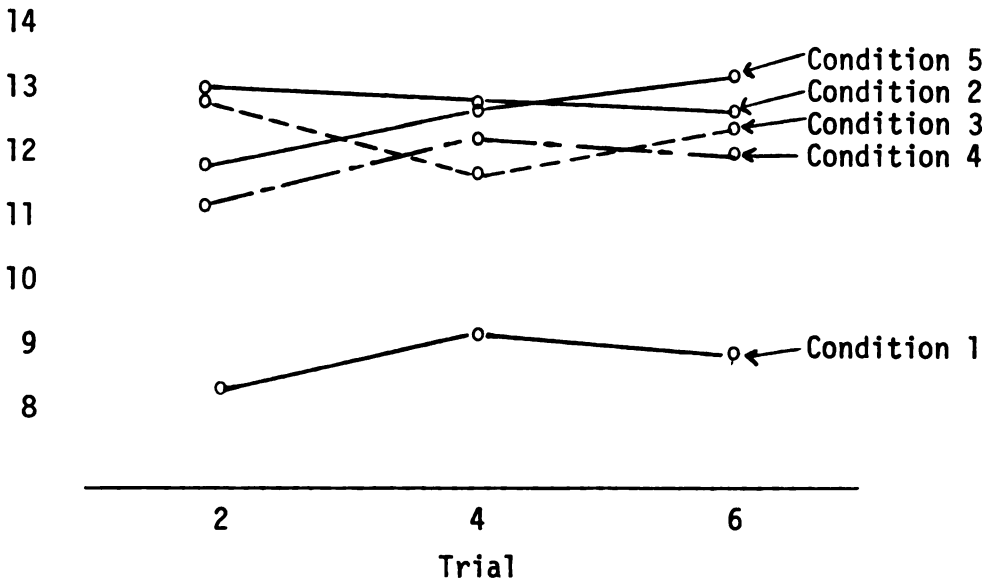


Figure 6. Mean perception of external control by frequency of feedback condition

in the baseline condition (Condition #1) were the least satisfied of the experimental groups ($\bar{X}$ = 27.19).

Test of Hypotheses

Analysis of variance. To test the hypotheses of the experiment, two types of analyses were performed. The first of these analyses pertained to the effects of the different experimental conditions on perception of control, task performance, and intrinsic task satisfaction. Two types of analysis of variance were performed. First, a multivariate analysis of variance or MANOVA (Hull & Nie, 1981) was performed using a 5 (feedback conditions) x 3 (repeated measures) design. The measures of personal control and external control collected following the second, fourth, and sixth trials

were entered into the MANOVA as dependent variables. Performance (measured by the number of correct problem solutions) for the second, fourth, and sixth trials was also included as a dependent variable in the MANOVA. Because intrinsic task satisfaction was measured only once and because this measurement was separate from the other dependent variables, intrinsic task satisfaction was not included as a dependent variable in the overall MANOVA.

Use of MANOVA was based on the assumption that the dependent variables would be moderately intercorrelated. This assumption proved to be justified. Table 15 presents the correlation coefficients for the four dependent variables. The correlations appearing in Table 15 were calculated based on performance during the sixth trial and subjects' perceptions following the sixth trial. Of these four dependent variables, only intrinsic task satisfaction was not included in the overall MANOVA.

Table 15

Intercorrelation of the Dependent Variables

Variables	1	2	3	4
1. Personal control	-			
2. External control	.37**	-		
3. Performance	.27*	.07	-	
4. Satisfaction	.29*	.03	.29*	-

* $p < .05$

** $p < .01$

The results of the MANOVA are presented in Table 16. While the multivariate tests for trials and the interaction of feedback condition by trials proved to be nonsignificant, the main effect of feedback condition was significant using Wilks multivariate test of significance (@ $F = 5.42$, 12 df, $p < .001$). As the next step of the analysis process, a series of univariate ANOVAs were calculated. The first hypothesis was that frequency of feedback beyond the "desired" level for the task would affect the feedback recipient's perception of control. Univariate F-tests for feedback condition were significant for both the measures of personal control ($F = 3.16$, $p < .015$) and external control ($F = 9.94$, $p < .001$). As was anticipated from inspection of Figure 5 illustrating the results for personal control and Figure 6 for perception of external control, post-hoc contrasts showed that persons in Condition #1 (feedback at the end of the trial only) perceived that they had significantly less personal control and external control during the experiment (see Table 17).

The second hypothesis was that increasing the frequency with which feedback was given would have a positive effect on task performance. The univariate F-test for feedback condition was significant for task performance ($F = 4.73$, $p < .001$). Post-hoc contrasts supported the earlier inspection of mean performance in that performance in Condition #5 (decreasing feedback frequency) proved to be significantly lower than performance in the other four feedback conditions (see Table 18).

No a priori hypothesis was made concerning the effect of frequency of feedback on intrinsic task satisfaction. The measure of intrinsic

Table 16

Multivariate and Univariate Tests of Significance for the Personal Control, External Control, and Performance Measures

	Multivariate Analysis of Variance Using Wilks Multivariate Test of Significance			
Effect	Value	Approx. F	Hyp. df	Sign. of F
Condition	.750	5.42	12	.001
Trials	.961	1.44	6	NS
Condition x Trials	.971	.27	24	NS

	Univariate Analysis of Variance for Frequency of Feedback Condition			
Dependent Variable	Hyp. SS	Error SS	F	Sign. of F
Performance	1023.07	11680.72	4.73	.001
Personal control	193.55	3311.46	3.16	.015
External control	449.50	2441.96	9.94	.001

with (4,216) df

Table 17

Results of Post-Hoc Contrasts Between Feedback Conditions for the Personal Control and External Control Scales

Condition 1 vs. Condition:	Personal Control Scale Coeff.	Strd. Error	T-value	Sign. of T
2	2.319	.812	2.85	.01
3	1.604	.799	2.01	.05
4	2.453	.812	3.02	.01
5	2.208	.812	2.72	.01

(using simple contrasts)

Condition 1 vs. Condition:	External Control Scale Coeff.	Strd. Error	T-value	Sign. of T
2	3.864	.698	5.54	.001
3	3.271	.686	4.77	.001
4	2.797	.698	4.01	.001
5	3.419	.698	4.90	.001

(using simple contrasts)

Table 18

Results of Post-Hoc Contrasts Between Feedback Conditions for Performance

Condition 5 vs. Condition:	Coeff.	Strd. Error	T-value	Sign. of T
1	4.554	1.526	2.98	.003
2	6.267	1.550	4.04	.001
3	4.575	1.526	3.00	.01
4	4.978	1.550	3.21	.01

(using simple contrasts)

task satisfaction was analyzed using a one-way analysis of variance (ANOVA) SPSS program (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975) with frequency of feedback condition as the sole independent variable. The results of this ANOVA proved to be nonsignificant (F = 0.632, NS). These results are presented in Table 19.

Table 19

Univariate Analysis of Variance Results for Intrinsic Task Satisfaction Scale

Source	df	SS	MS	F	Sign. of F
Condition	4	70.48	17.62	.632	NS
Error	72	2008.04	27.89		
Totals	76	2078.52			

Correlational Results. The final stage of the data analysis was to conduct a correlational analysis to examine the relationship between the feedback recipients' perceptions of control and the outcome variables of task performance and intrinsic task satisfaction. As the final step in this part of the data analysis, a series of exploratory path analyses were performed in order to gather preliminary data on the potential causal links between these variables. The intercorrelations between these variables were previously presented as Table 15. For the purposes of the correlational analysis, the personal and external control variables in Table 15 refer to the measures of personal control and external control that appeared on the questionnaire completed by participants following the sixth trial. Similarly, "performance" refers to participants' performance on the sixth trial.

The third hypothesis of the present experiment was that there would be a positive relationship between perception of external control and task performance. This hypothesis was not supported. The correlation between participants' perception of external control and their task performance was not significant ($r = .07$, NS). In contrast, the fourth hypothesis that participants' perception of personal control would be positively related to task performance did receive support in the major experiment. Subjects' perceptions of personal control were significantly related to their task performance ($r = .27$, $p < .05$).

The fifth and sixth hypotheses of the present study involved the expected relationship between feedback recipients' perceptions of personal control and external control and the outcome variable

of intrinsic task satisfaction. The fifth hypothesis was that participants' perceptions of external control would be negatively related to their satisfaction with the task. This hypothesis was not supported by the results of the major experiment. The correlation between perception of external control and intrinsic task satisfaction was not significant at the .05 level ($r = .03$, NS). The sixth hypothesis pertained to the expected positive relationship between participants' perceptions of personal control and intrinsic task satisfaction. The correlation between perception of personal control and intrinsic task satisfaction was significant ($r = .29$, $p < .05$), so the sixth hypothesis was supported.

One issue that caused confusion in predicting how increasing frequency of feedback would affect the outcome variables was the relationship between perception of external control and perception of personal control. In the present study, these two types of perception of control were positively related ($r = .37$, $p < .01$). However, some caution should be used in generalizing from this finding. Common method variance may explain both the magnitude and direction of the relationship that was found between perceptions of personal and external control.

The final step in the correlational analysis stage was to conduct a series of exploratory path analyses. Path analyses were conducted using the path analysis routine from PACKAGE (Hunter, Gerbing, Cohen, & Nicol, 1980). Prior to entering the intercorrelations into the path analysis program, the correlations between the dependent variables were corrected for attenuation due to unreliability in the measure. These corrected correlation coefficients appear as Table 20.

Table 20

Intercorrelation of the Dependent Variables After Correction for Attenuation

Variables	1	2	3	4
1. Personal control	-			
2. External control	.53	-		
3. Performance	.29	.09	-	
4. Satisfaction	.36	.05	.33	-

Frequency of feedback condition was dummy-coded so that it could be included in the path analyses and allow for a more complete test of the updated model of the feedback process. The resulting correlations between frequency of feedback condition and each of the four dependent variables are presented in the upper portion of Table 21. As can be seen from the values presented in the Table, the size of the correlations between frequency of feedback conditions and perceptions of personal and external control were generally low. The path coefficients for the five frequency of feedback conditions and the results of the path analyses for each condition are also presented in Table 21. The two "best" path models in terms of minimizing the sum of squared deviations are presented as Figure 7. Both of these models exhibit a direct relationship between personal control, performance, and task satisfaction. The only difference between the two models is the position of the performance and

Table 21

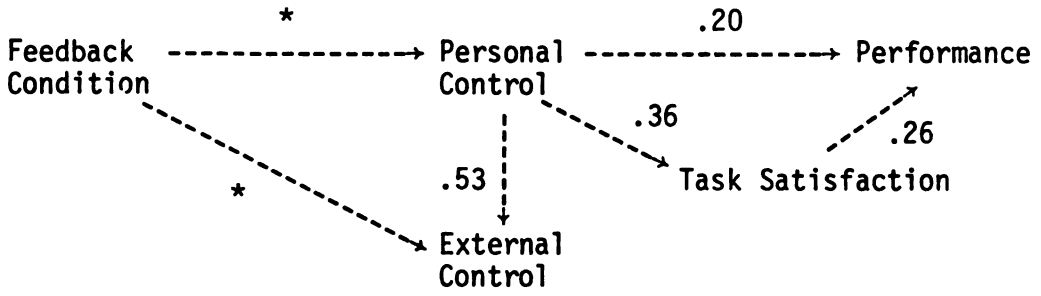
Correlations, Path Coefficients, and Results of the Path Analyses for Frequency of Feedback Conditions

	Frequency of Feedback Conditions				
	1[a]	2	3	4	5
Correlations					
Personal control	-.28	.05	.03	.07	.13
External control	-.39	.13	.07	.04	.16
Performance	.03	.19	.04	.04	-.30
Satisfaction	-.14	.13	-.05	.05	.01
Path Coefficients[b]					
Personal control	-.28	.05	.03	.07	.13
External control	-.27	.10	.05	.01	.09
Results					
Sum of Squared Deviations	.04	.07	.03	.03	.14

a = For Condition 1, the path coefficient for the link between personal and external control was .46 rather than .53.

b = Values for path coefficients and for the sum of squared deviations were identical for Model A and Model B.

Model A



Model B

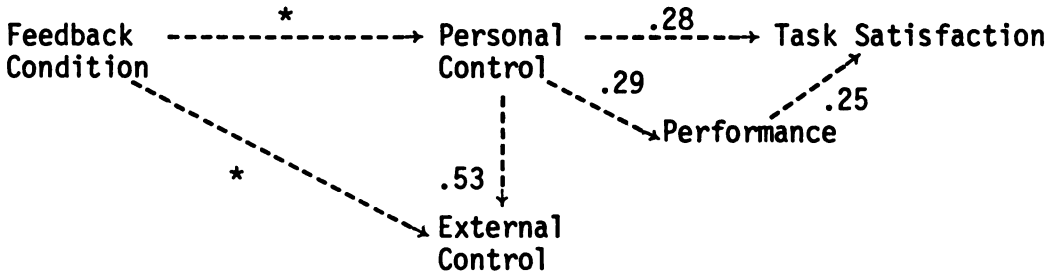


Figure 7. Exploratory path models

* = Values for these path coefficients are presented in Table 21.

intrinsic task satisfaction variables. In other words, some ambiguity remains following the path analyses as to the nature of the relationship between these two outcome variables. In addition, both of the models virtually ignore the external control variable. Only the perception of control variable appears to have any significant impact on the external control variable. The data do not allow for an unequivocal decision as to which of these two models best represents the "true" relationship between the dependent variables.

DISCUSSION

Overview

The discussion is divided into several sections. The first section discusses the implications of the results of the major experiment for the hypotheses of the study. The next section deals with the limitations of the major experiment. This is followed by a section dealing with implications of the present experiment for future studies. The discussion section concludes by examining the implications of the present study for feedback research in general.

Implications of Results for Major Hypotheses

The first hypothesis for the major experiment was that increasing the frequency of feedback beyond the "desired" level for a task would affect the feedback recipient's perceptions of control. Both perceived external and personal control were measured in the major experiment. The first hypothesis was supported for both measures of perceived control. The univariate ANOVA reported that there was a significant main effect for the frequency of feedback condition on perceptions of both external and personal control. In addition, Corollary A stated that increasing the frequency of feedback beyond the desired level would result in an increasing perception of external control on the part of the feedback recipient. This

corollary received partial support in the results of the major study. The first preliminary study established that, in general, people performing the Number Facility Task preferred to receive a minimal amount of feedback (usually once per trial). In Condition #1 of the major experiment, the participant received feedback about his or her performance only at the end of each trial. The results of the post-hoc contrasts showed that persons in Condition #1 reported perceiving significantly less external control than persons in the other four frequency of feedback conditions. However, a glance at Figure 5 reveals that increasing violation of the "desired" level for feedback frequency did not translate into a linear increase in perception of external control. The results for the measure of personal control show that persons who received feedback at the "desired" frequency level perceived that they had significantly less personal control than did individuals who received more frequent feedback. The measures of personal control and external control that were used in the major experiment had a relatively high positive intercorrelation ($r = +.37$, $p < .05$; corrected for unreliability, $r = +.53$).

The second hypothesis was that increasing frequency of feedback levels would lead to increases in task performance. This hypothesis received some support in the major experiment. The univariate ANOVA reported that there was a significant main effect for frequency of feedback condition for performance. However, mean performance was not highest in the condition that received the most frequent feedback (Condition #3). Instead, the highest average performance was found in the group that received feedback only twice per trial

(Condition #2). It is possible that the more frequent feedback messages in Condition #3 interfered with subjects' concentration on the task. This potential problem with frequent feedback messages was cited by several of the participants in the first preliminary study as the reason for their low level of "desired" feedback while a trial was in progress. In addition, significantly lower performance was found in the condition in which feedback frequency was reduced as the experiment progressed (Condition #5).

The third hypothesis was that there would be a positive relationship between perceptions of external control and performance on the task. This hypothesis was based on the assumption that the demand characteristics of the laboratory situation would increase compliance with external attempts to control the participant's behavior. This hypothesis was not supported by the results of the major experiment. The correlation between perception of external control and performance was in the correct direction but was not significantly different from zero ($r = .07$, NS).

The fourth hypothesis was that there would be a positive relationship between perception of personal control and task performance. This hypothesis was supported by the results of the major experiment. The correlation between personal control and performance was significantly different from zero ($r = .27$, $p < .05$). This supports the findings of Fisher (1978) that personal control is positively related to performance.

The fifth hypothesis dealt with the relationship between perception of external control and intrinsic task satisfaction.

Based on Cognitive Evaluation Theory (Deci, 1975) and Mossholder's (1980) arguments about the relationship between measures of intrinsic motivation and measures of task satisfaction, the fifth hypothesis proposed that persons who thought that they were being externally controlled should have reported less satisfaction with the task. This did not prove to be the case in the major experiment. Participants' perceptions of external control were not significantly correlated with their perceived task satisfaction ($r = .03$, NS).

The final hypothesis concerned the relationship between perception of personal control and intrinsic task satisfaction. Again based on the arguments of Deci (1975) and Mossholder (1980), the sixth hypothesis for the major experiment was that there would be a positive relationship between participants' perceptions of personal control and their intrinsic satisfaction with the task. The results of the major experiment supported this hypothesis. There was a significant positive correlation between perceived personal control and the intrinsic task satisfaction scale ($r = .29$, $p < .05$).

Limitations of the Study

There are a number of limitations to the generalizability of the present study. The first such limitation is the type of task used. While addition problems possessed a number of desirable characteristics for the theoretical purposes of the present study, the external validity of any of the results of the study are limited by the use of such a task. Future studies examining the effects of feedback dimensions on the various process and outcome variables might wish to employ tasks which more closely simulate tasks that are performed in the regular work environment (e.g., data entry or judgemental tasks).

A second limitation of the study was that only one of the three proposed process variables (informational, motivational, and perception of control) was actually measured during the course of the experiment. As a result, one must resort to subjective observation of the way that people reacted during the experiment in order to infer whether or not the feedback messages impacted on the other two process variables in addition to affecting perception of control. Based on this type of informal observation of participants' behavior, it can be argued that some of the decline in performance in Condition #5 was due to a lack of information and/or a decline in motivation to perform the mundane task. There is little doubt on the part of this experimenter that the feedback messages were having either a motivational or an informational effect on many of the participants in the experiment. Many of these persons seemed to "get into" the competitive aspects of the task by using the previous trial's performance as a self-set goal and using the feedback messages during the next trial as a means of monitoring performance in relation to that goal. However, it is impossible to tell from these informal observations whether the feedback message itself was motivating these individuals or was simply serving to inform them about their performance in relation to a self-set specific goal (see Locke et al., 1981).

A third limitation of the present study involves the measures of personal control, external control, and task satisfaction. Even though there was some amount of change in participants' perceptions of control during the course of the experiment, the true purposes of the questionnaires may have been perceived by the participants. One would also expect to find that the correlations between these three variables were inflated to a certain extent due to common method bias.

However, while this explanation might account for part of the moderate correlation between the measures of perception of personal control and external control (r = .37), it does not account for the fact that the external control measure was not significantly related to the measure of intrinsic task satisfaction (r = .03) while the personal control measure had a moderate correlation (r = .30) with the measure of task satisfaction. The relatively low level of internal consistency for the external control measure may also have seriously affected the size of any intercorrelation between this variable and the other dependent variables.

Implications for Future Studies

Frequency of feedback did not have the expected effect on perceptions of external control. However, Ilgen et al.'s (1979) argument that frequency of feedback would increase perception of external control was based on the assumption that, in an industrial setting, monitoring of performance would have to be increased in order to increase frequency of feedback. This change in the level of monitoring of behavior did not occur in the present experiment. Monitoring of behavior was constant in all of the frequency of feedback conditions. Future experiments which alter the level of surveillance in addition to frequency of feedback might find more support for a relationship between frequency of feedback and perception of external control.

Previous researchers have tended to assume that an increase in perceived external control would result in a decrease in perceived personal control. However, the measures of personal and external control used in the present study were positively correlated with one

another (r = .37). This finding has two potential implications for the measurement of perception of control. First, the size and direction of the intercorrelation between the measures of perceived personal and external control suggests the possibility of combining these two scales into a single measure of the construct of perceived control. If, however, personal control and external control represent separate constructs, then more effort is required to develop better measures of these constructs. This suggests that more effort needs to be placed on validating the constructs and measures of perceived personal control and perceived external control.

Future studies are also needed that examine the effects of withdrawing feedback. The post-hoc contrasts confirmed that performance was significantly worse in the condition in which feedback decreased in frequency during the course of the experiment (Condition #5). In addition, this feedback condition was the only one in which performance declined rather than increased on the final trial. An article by Salmoni, Schmidt, and Walter (1984) suggests that the difference between performance on a task when feedback from an external source is present and when it is withdrawn represents a measure of learning for the task. According to Salmoni et al. (1984), if external feedback is given too frequently, the individual may not learn the informational cues that are provided by the task itself. These findings highlight the need to more closely examine the impact of withdrawal of feedback on recipients' perceptions and performance. Salmoni et al. (1984) argue that experiments which use external feedback should include a minimal feedback condition in order to monitor the "true" level of learning and performance for the task.

In the case of the present experiment, this would suggest the addition of a seventh trial in which all participants received feedback at only the end of the trial.

In the future, studies should also attempt to include measures of all three of the process variables shown in Figure 2 (i.e., informational, motivational, and controlling). For example, in a recent study using addition problems, Matsui, Okada, and Osamu (1983) suggested that feedback may only have motivational or controlling effects for persons who are not making adequate progress towards some goal. Matsui et al. (1983) measured motivation by asking subjects how hard they intended to work on the second half of a trial based upon their first half performance. This study illustrates one rather simple method of operationalizing the motivational process variable. It might be possible to measure the informational process variable in a similar manner by asking participants to respond to simple objective questions regarding their performance both at the middle and end of one or more trials. For example, subjects in the present experiment might have been asked whether their performance on the present trial was worse than, the same, or better than their performance at the same point in the previous trial. Understanding of the outcomes of the present experiment would have been increased if data had been collected on the informational and motivational value of the feedback. Without this information, one was forced to rely on subjective impressions gathered during the course of running subjects rather than on hard data. However, it should be kept in mind that the present study represents the first attempt to directly measure the effects of frequency of feedback on the process variable of perception of control.

Studies which examine the effects of the other dimensions of feedback on specific process variables might also prove fruitful. The updated model of the feedback process presented in Figure 2 can act as an aid in generating testable hypotheses involving the other dimensions of feedback. For example, the dimensions of prescriptiveness and evaluativeness might be perceived as either informational or externally controlling by a feedback recipient. The quantity of feedback that is received at one time might be expected to affect the informational value of feedback. Using the model provided in Figure 2, future studies should attempt to evaluate which dimensions of feedback have the greatest impact on the process variables.

The effects of the "desired" frequency of feedback level on perceptions of personal and external control are worthy of future study. Persons in the "desired" frequency of feedback condition (Condition #1) reported perceiving low levels of both personal and external control. The reasons for the low level of perceived personal control in this condition merit closer attention.

Implications for Feedback in General

The major implication of the study is that changes in the dimensions of feedback may have effects on perceptions of control. This supports the notion that we can increase our understanding of how feedback affects outcome variables by studying intervening perceptual process variables. How the feedback message is perceived ultimately determines its impact. The significant correlations that were found between perception of personal control and the measures of

performance and intrinsic task satisfaction support the merits of the inclusion of perceptual variables in studying the effects of feedback on performance. However, this may not be a one-way process. To a certain extent people who are able to perform well on a task may feel that they have more personal control than do lesser performers.

The effects of the frequency of feedback conditions on performance did not support the notion that more feedback is always better. In this case, the group that received slightly more feedback than was originally desired (i.e., two times per trial) proved to have the best performance. As was noted previously, this effect may be due to the amount of interference that the more frequent messages caused. However, persons in the conditions in which frequency of feedback changed during the course of the experiment had two trials in which they too only received feedback twice for each trial. In neither of these conditions did the mean performance on these two trials increase to any dramatic extent. Therefore, the interference explanation should be treated with some caution.

Finally, Larson (1984) has suggested that researchers should also examine the effects of <u>giving</u> feedback on the perceptions of the feedback <u>source</u>. According to Larson (1984), regardless of the effect that a feedback message may have on the perceptions of subordinates, the act of providing feedback alone may increase supervisors' perceptions of power and control over those subordinates. These perceptions may have future behavioral implications for both the supervisor and the subordinate.

APPENDICES

APPENDIX A

APPENDIX A

Personal Control Items

1. The amount of effort that I put in determined how well I performed on this set of problems.
2. The number of problems that I finished in this set was primarily the result of my own ability.
3. How hard I tried determined how well I performed on this set of problems.
4. How hard I concentrated on the task determined the number of problems that I was able to complete in this set.

External Control Items

1. The number of problems that I finished in this set was affected by the difficulty level of the items.
2. The number of problems that I completed was affected by the number of outside distractions.
3. In comparison with the previous problems, the problems in this set seemed a little harder.

*4. It seemed that I had little control over how many problems I finished in this set.

*5. The luck of the draw played a role in how well I did on this problem set.

* These items were later excluded due to reliability problems

APPENDIX B

APPENDIX B

1----------2----------3----------4----------5----------6----------7
Very Dissatisfied Neutral Satisfied Very
Dis- Satisfied
satisfied

REACTION

1. This is how I would describe the feelings of accomplishment that I got from the task. _____

2. This is how I feel about the chance to do something that made use of my math abilities. _____

3. This is how I feel about the amount of competition that was present in the task. _____

4. How satisfied were you about working with the task itself? _____

5. To what degree do you think that this task was interesting?

1----------2----------3----------4----------5----------6----------7
Very Interesting Neutral Boring Very
Inter- Boring
esting

6. How much did you enjoy working on this task?

1----------2----------3----------4----------5----------6----------7
Strongly Disliked Neutral Enjoyable Very
Dis- Enjoyable
liked

APPENDIX C

APPENDIX C

Results of Factor Analysis with Oblique Rotation

Structure Matrix

Items	Factors 1	2	3
1	.78	.24	-.27
2	.57	.36	-.45
3	.86	.25	-.26
4	.70	.37	-.02
5	.43	.97	-.10
6	.09	.38	.15
7	.09	.23	.15
8	-.32	-.06	.40
9	-.04	.19	.56
Eigenvalues	2.68	.92	.55
Pct. of Var.	64.6	22.2	13.2

Note. Item order corresponds to the order in which the items appear in Appendix A.

APPENDIX D

(Supplemental Materials)

APPENDIX D

Outline of Experimental Procedures

Before subject arrives:

1. Plug in adapter for the calculator and make sure that the calculator is working.
2. Make sure that there is plenty of scrap paper.
3. Have problem sets arranged in order from A to H. Also, make sure that each set starts with card number 1 (ex. A-1).
4. Get a new informed consent form and place on the table where the subject will sit.
5. From the shelves, get 3 copies of the problem questionnaire and 1 copy of the final questionnaire. In the upper right-hand corner of the final questionnaire, write the future subject's subject number. In the upper right-hand corner of the problem questionnaire, write the future subject's number and what problem set the questionnaire will be given after. For example, for subject number 2, the questionnaire that will be given following the 4th problem set should be coded as 2-4. Remember, problem set questionnaires are to be given following the completion of the second, fourth, and sixth problem sets (A.K.A. trials). So, before subject number 2 arrives, you would write 2-2 on one copy of the problem set questionnaire, 2-4 on another, and 2-6 on the third copy.
6. Look at the sheet entitled "Assignment of Subjects to Conditions." Find the condition under which the upcoming subject's number is listed. That will tell you which data collection sheet you need.

For example, subject number 1 is in condition 2, so you would get a sheet labeled "Data Collection Sheet 2." The data collection sheet itself helps tell you how often you should give feedback in that condition. Make sure that you write the subject's number in the space provided at the top of the data collection sheet.

After subject arrives:

1. Ask the subject to read but not sign the informed consent form.
2. Read the instructions from page 1 of the instructions sheet to the subject.
3. At the appropriate time (cued at the end of the instructions), ask the subject to sign the informed consent form. Then collect the consent form and place it on the appropriate pile on the shelves.
4. Give the subject the practice problems.
5. Before the subject starts on a problem set:
   a) record which problem set (A-H) the subject is working on in the space provided on the data collection sheet.
   b) get the proper "correct answer sheet" (A-H) ready.
   c) cut the start of the problem set deck so that the subject is starting with a problem between 1 and 20 but not with numbers 1, 5, 10, 15, or 20.
   d) give the subject about 30 seconds warning before the start of each trial.
6. Subjects have 4 minutes to do as many problems as they can.
7. When the subject writes down a problem solution, check the answer with your answer sheet. Use the calculator to keep

track of the number correct. Make a slash mark in the appropriate space when the subject gets a problem wrong.

8. WHEN GIVING FEEDBACK ALWAYS SAY "X CORRECT IN Y MINUTES." If the subject asks about the number he/she got wrong, tell him/her that you will be willing to discuss that at the end of the experiment.
9. Cross off the time numbers on the data collection sheet to help you keep track of time passed within the trial.
10. At the end of a trial, write the total number correct in the space provided. NOTE: the total correct should always equal the number right after 4 minutes.
11. To give the subject a short break between trials, sort the problem set cards back into their proper order after the subject has finished the problem set. This also helps to cut turnaround time between subjects.
12. Before you give the first problem questionnaire, read the instructions for the problem set questionnaires on page 2 of the instructions sheet to the subject. Always make sure that you have the questionnaire that is coded to be given after the just-completed trial. When giving the problem set questionnaire for the second and third time, simply remind the subject that the questionnaire is attempting to get his/her reaction to the problem set which he/she has just completed. REMEMBER: give the problem set questionnaires AFTER the subject has completed the second, fourth, and sixth trials.
13. DO NOT STARE AT A SUBJECT WHILE HE/SHE IS FILLING OUT ANY OF THE QUESTIONNAIRES.

14. Give the final questionnaire after the subject has finished filling out the problem set questionnaire for trial 6. Before giving the final questionnaire, read the instructions for the final questionnaire (p. 2 of the instructions sheet) to the subject.
15. After the subject has completed the final questionnaire, read the statement listed under "Debriefing" (p. 2 of the instruction sheet) to the subject and attempt to answer any questions that the subject may have about the experiment.

After subject leaves:

1. Place the completed data collection sheet, problem set questionnaires, and final questionnaire in their proper folders.
2. Cross off the subject's number from the sheet entitled "Assignment of Subjects to Conditions."
3. Throw away the used scrap paper.
4. Prepare the necessary materials for the next subject. Even if this was the last subject of the day, getting everything set up will make it easier to get started the next day.

Instructions

NOTE: Read the following instructions after the participant has read the consent form and prior to their signing the consent form:

In this experiment you will be asked to solve several sets of addition problems. The problems are written on 3 x 5 cards (show cards). Your task is to write the solution to a given problem on those small blank pieces of paper (show scrap paper). You are not allowed to make any marks on the 3 x 5 cards themselves but you are allowed to make any kind of mark that you desire on the scrap paper. After writing down your solution, we ask that you place the answer paper somewhere in the center of the table so that I can read it. You will then continue on with the next problem. I will check your answers and keep track of your total number correct for each set of problems. From time to time, I will also give you feedback about how you are doing. Please work as fast and as accurately as you can. You will have a time limit of four minutes for each set of problems. It is important that you remember that the trial is not over until I say "Time!" We will be doing a total of six problem sets.

I will also be asking you to fill out two different types of questionnaires. One type will be given after every other problem set and attempts to get your reactions to that problem set. After a short break we will then continue on with the next set of problems. The second type of questionnaire will be given at the end of the experiment and attempts to get your reactions to the task as a whole. Do you have any questions regarding

the task? (Answer questions) If not, I would ask you to sign the consent form now. (after collecting signed consent form) We will begin with some practice problems. These are not checked and you can do as many of them or as few of them as you like. (after practice problems) Please pick a letter between A and H.

After second problem set:

I now ask you to fill out this short questionnaire. Remember that the items on this questionnaire attempt to get your reactions to this problem set. (give short break after finish filling our questionnaire)

I now ask you to fill out this final questionnaire. Remember that the items on this questionnaire attempt to get your reactions to the task as a whole.

DEBRIEFING

This experiment is attempting to study the effects of feedback on performance on a mundane task and on people's perceptions of that task. Several recent theories have suggested that one way to increase motivation and performance is to increase the amount of feedback that is given to the worker. We are attempting to see if this is true and also examine some possible side-effects this increase in feedback might have. Do you have any questions?

- Data Collection Sheet1

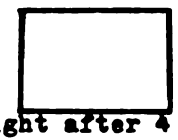
Subject Number: _____

Condition No.: 1

****

1. Problem Set: _____ No Questionnaire _____

wrong



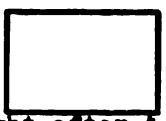
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

****

2. Problem Set: _____ Give Questionnaire _____

wrong



right after 4 minutes

Time 1 2 3 4 Total Correct: _____

****

3. Problem Set: _____ No Questionnaire _____

wrong

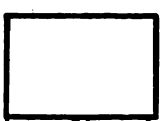
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

****

4. Problem Set: _____ Give Questionnaire _____

wrong



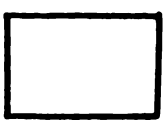
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

****

5. Problem Set: _____ No Questionnaire _____

wrong



right after 4 minutes

Time 1 2 3 4 Total Correct: _____

****

6. Problem Set: _____ Give Questionnaire _____

wrong

right after 4 minutes

Time 1 2 3 4 Total Correct: _____

Data Collection Sheet2

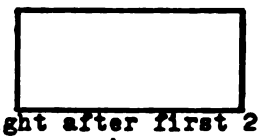
Subject Number: _____

Condition No.: 2

****

1. Problem Set: _____ No Questionnaire! _____

wrong



right after first 2 mins.

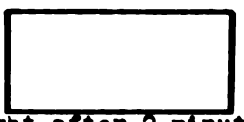
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

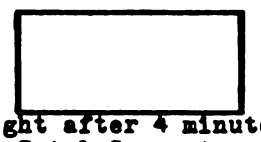
****

2. Problem Set: _____ Give Questionnaire! _____

wrong



right after 2 minutes



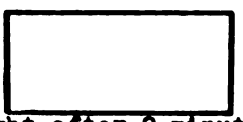
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

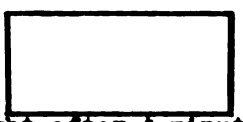
****

3. Problem Set: _____ No Questionnaire! _____

wrong



right after 2 minutes



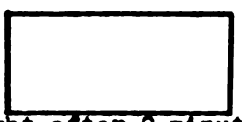
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

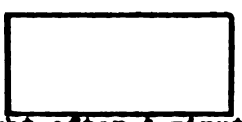
****

4. Problem Set: _____ Give Questionnaire! _____

wrong



right after 2 minutes



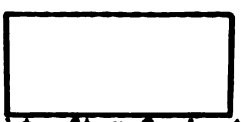
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

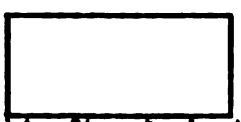
****

5. Problem Set: _____ No Questionnaire! _____

wrong



right after 2 minutes



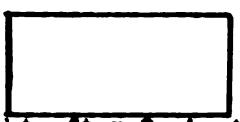
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

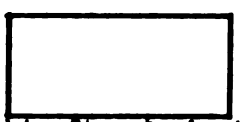
****

6. Problem Set: _____ Give Questionnaire! _____

wrong



right after 2 minutes



right after 4 minutes

Time 1 2 3 4 Total Correct: _____

Data Collection Sheet3

Subject Number: _____

Condition No.: 3

****

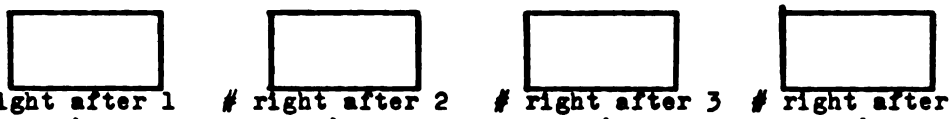
1. Problem Set: _____ No Questionnaire! _____ # wrong

right after 1 min. # right after 2 min. # right after 3 min. # right after 4 min.

Time 1 2 3 4 Total Correct: _____

****

2. Problem Set: _____ Give Questionnaire _____ #wrong

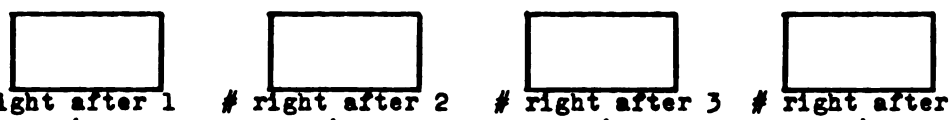


right after 1 min. # right after 2 min. # right after 3 min. # right after 4 min.

Time 1 2 3 4 Total Correct: _____

****

3. Problem Set: _____ No Questionnaire _____ #wrong



right after 1 min. # right after 2 min. # right after 3 min. # right after 4 min.

Time 1 2 3 4 Total Correct: _____

****

4. Problem Set: _____ Give Questionnaire _____ #wrong

right after 1 min. # right after 2 min. # right after 3 min. # right after 4 min.

Time 1 2 3 4 Total Correct: _____

****

5. Problem Set: _____ No Questionnaire _____ #wrong

right after 1 min. # right after 2 min. # right after 3 min. # right after 4 min.

Time 1 2 3 4 Total Correct: _____

****

6. Problem Set: _____ Give Questionnaire _____ #wrong

right after 1 min. # right after 2 min. # right after 3 min. # right after 4 min.

Time 1 2 3 4 Total Correct: _____

Data Collection Sheet4

Subject Number: _____

Condition No.: 4

****

1. Problem Set: _____ No Questionnaire _____

wrong

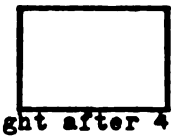
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

****

2. Problem Set: _____ Give Questionnaire _____

wrong



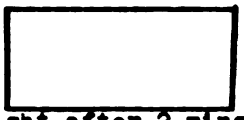
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

****

3. Problem Set: _____ No Questionnaire _____

wrong



right after 2 mins.

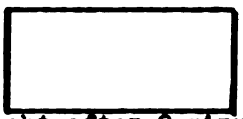
right after 4 mins.

Time 1 2 3 4 Total Correct: _____

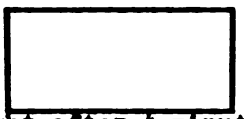
****

4. Problem Set: _____ Give Questionnaire _____

wrong



right after 2 minutes



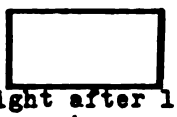
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

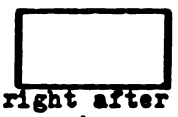
****

5. Problem Set: _____ No Questionnaire _____

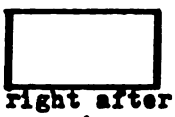
#wrong



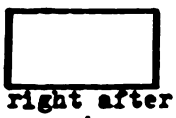
right after 1 min.



right after 2 min.



right after 3 min.



right after 4 min.

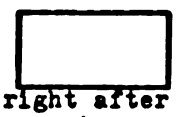
Time 1 2 3 4 Total Correct: _____

****

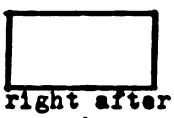
6. Problem Set: _____ Give Questionnaire _____

#wrong

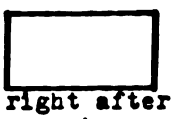
right after 1 min.



right after 2 min.



right after 3 min.



right after 4 min.

Time 1 2 3 4 Total Correct: _____

Data Collection Sheet5

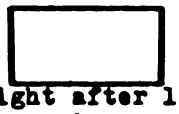
Subject Number: _____

Condition No.: 5

****

1. Problem Set: _____ No Questionnaire _____

#wrong



right after 1 min. | # right after 2 min. | # right after 3 min. | # right after 4 min.

Time 1 2 3 4 Total Correct: _____

****

2. Problem Set: _____ Give Questionnaire _____

#wrong

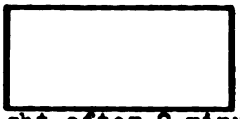
right after 1 min. | # right after 2 min. | # right after 3 min. | # right after 4 min.

Time 1 2 3 4 Total Correct: _____

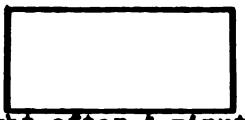
****

3. Problem Set: _____ No Questionnaire _____

wrong



right after 2 minutes



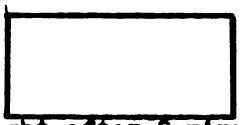
right after 4 minutes

Time 1 2 3 4 Total Corract: _____

****

4. Problem Set: _____ Give Questionnaire _____

wrong



right after 2 minutes

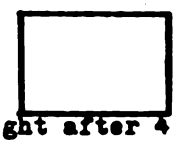
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

****

5. Problem Set: _____ No Questionnaire _____

wrong



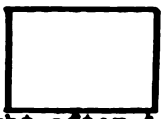
right after 4 minutes

Time 1 2 3 4 Total Correct: _____

****

6. Problem Set: _____ Give Questionnaire _____

wrong



right after 4 minutes

Time 1 2 3 4 Total Correct: _____

Problem Set Questionnaire

INSTRUCTIONS. Please give your reactions on the following set of statements as they apply to the set of problems which you have just completed. Please use the following scale to answer statements 1 thru 9:

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Mildly Disagree	Neutral	Mildly Agree	Agree	Strongly Agree

REACTION ↓

1. The amount of effort that I put in determined how well I performed on this set of problems. ____
2. The number of problems that I finished in this set was affected by the difficulty level of the items. ____
3. The number of problems that I finished in this set was primarily the result of my own ability. ____
4. How hard I tried really determined how well I performed on this set of problems. ____
5. The number of problems that I completed was affected by the number of outside distractions. ____
6. In comparison with the previous problems, the problems in this set seemed a little harder. ____
7. How hard I concentrated on the task determined the number of problems that I was able to complete in this set. ____
8. It seemed that I had little control over how many problems I finished in this set. ____
9. The luck of the draw played a role in how well I did on this problem set. ____

Final Questionnaire

INSTRUCTIONS. Please give your reactions to the following set of statements as they apply to the task as a whole. Please use the following scale to answer items 1 thru 4:

```
  1----------2----------3----------4----------5----------6----------7
Very    Dissatisfied           Neutral              Satisfied    Very
Dissatisfied                                                  Satisfied
```

REACTION ↓

1. This is how I would describe the feelings of accomplishment that I got from the task. _____

2. This is how I feel about the chance to do something that made use of my math abilities. _____

3. This is how I feel about the amount of competition that was present in the task. _____

4. How satisfied were you about working with the task itself? _____

On items 5 and 6, please place a check over the number that best describes your reaction.

5. To what degree do you think that this task was interesting?

```
  1----------2----------3----------4----------5----------6----------7
Very    Interesting            Neutral              Boring      Very
Interesting                                                    Boring
```

6. How much did you enjoy working on this task?

```
  1----------2----------3----------4----------5----------6----------7
Strongly   Disliked             Neutral              Enjoyable    Very
Disliked                                                      Enjoyable
```

7. In relation to the last set of problems that I did, I would have liked to have been told how I was doing on the set of problems:

_____more often.

_____at about the same rate.

_____less often.

8. Did you feel that the experimenter was trying to increase your performance from one trial to the next?

a) _____not at all

b) _____only a little bit

c) _____he was trying to increase my performance

d) _____he was making an obvious effort to increase my performance

If you answered b, c, or d above, how did you react to this influence attempt?

_____I tried to increase the number of problems that I did across the trials.

_____I felt that it was more important to work at my own pace rather than the experimenter's pace.

_____I specifically tried to keep my performance at about the same level across the six tables.

_____I tried to increase the number of problems that I did and didn't worry about errors.

_____I tried to decrease the number of problems that I attempted.

_____other (please explain)_____

_____

9. If I had a choice, the best rate at which I would have been given feedback about my performance would have been:

_____at the end of the experiment only.

_____after each problem set.

_____at the middle and at the end of each problem set.

_____several times during the problem set.

_____other (please explain)_____

_____

10. The frequency of information about my performance on the last set of problems, as compared with the first set of problems, was given:

_____less often.

_____at the same rate.

_____more often.

11. How often were you given information about your performance on the first problem set?_____

12. How often were you given information about your performance on the last problem set?_____

13. How many problems did you get correct on:

Set 1? _____ Set 4? _____

Set 2? _____ Set 5? _____

Set 3? _____ Set 6? _____

(If you can't remember, please give your best guess.)

Consent Form

The behaviors necessary and the task involved in this experiment have been explained to me. Any questions I might have about the task, including any inherent risk involved, have been answered to my satisfaction.

The experiment should require approximately one hour to complete. My participation in the experiment is voluntary. While my participation will provide me with extra class credit in my psychology course, a decision not to participate will not affect my present course grade.

I understand that all results of my performance will be treated with strict confidence and that all participants' performance records will remain anonymous. Within these restrictions, the final results of the experiment will be made available to me upon written request.

I understand that I will be fully debriefed at the conclusion of the experiment. Any questions I have that arise during the experiment will be answered at that time.

I have read and understand the above statement. I will consent to participate in this experiment without waiving my right to discontinue my participation in the experiment at any time without recrimination.

_____

Signature of student

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REFERENCES

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