Application of the Premack Principle of Reinforcement to the Quality Performance of Service Employees

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Abstract:

This study applied Premack's (1959, 1965) model of reinforcement to improving quality performance of service employees. Premack stated that for any pair of activities, the more probable or valued one will reinforce the less probable or less valued one. Quality performance was operationally defined and measured in the study by an observational instrument developed from a large-scale employee survey. Employees of a fast food restaurant chain in a medium-sized, midwest metropolitan area identified the most important quality performance dimensions for each workstation in the restaurant, and observers were trained to record those categories of performance with 90 percent interrater reliability. Performance of eight randomly selected employees at one of the restaurant locations was directly observed during a 7-week period. Five of the employees experienced an intervention derived from the Premack reinforcement model; if the quality of their performance exceeded baseline at a targeted workstation, they earned access to work time on their favorite station. A multiple baseline design across the five individuals was employed to assess the impact of this intervention; three employees who did not experience the intervention served as a control for maturation. The results provide beginning support for the use of reinforcement procedures derived from Premack's model in improving quality performance of service employees.

Article:

As post-industrial society has emerged, the service sector of the economy has become progressively more important in the United States. According to the most recent Bureau of Economic Analysis data, the service sector accounts for almost three-fourths of the GNP and over three-fourths of employment in the United States (Bowen & Cummings, 1990).

Unfortunately, some problems have accompanied the emergence of the service sector. Although there has been a recent resurgence in manufacturing productivity because of the application of advanced technology and downsizing, the service sector has not kept pace. Recent evidence from the Bureau of Labor Statistics indicates that since 1979 manufacturing productivity has increased an average of 4.1 percent per year, but nonmanufacturing has increased just 0.2 percent per year (Henkoff, 1991). While it should be recognized that measuring productivity in the service sector is less precise, a breakdown of the various industries within the service sector reveals considerable variability. For example, technologically based communications and financial industries have held their own when compared with growth rates in manufacturing productivity, while the labor intensive restaurant, grocery, and hotel industries have actually experienced negative productivity growth over the past ten years (Mandel, 1991). The restaurant industry in particular experienced a —0.4 percent annual rate of productivity growth over the past decade (U.S. Commerce Department data reported in Mandel, 1991).

With regard to measuring productivity in the service sector, it should be remembered that quality is as important as quantity. Riddle (1986) reflects this dual concern when she defines service productivity as "maximizing output of acceptable quality, while minimizing the total costs of the production process" (p. 72). In service industries such as fast food restaurants, which have already taken care of the quantity dimension of productivity, the improvement of quality performance becomes especially important.

There are clear challenges facing the service sector in general and the restaurant industry in particular. New thinking and new techniques are needed to improve quality performance of service employees in an increasingly competitive marketplace. The purpose of the present study was to assess the impact of a reinforcement procedure derived from the work of Premack on the performance of front-line employees in a fast food restaurant.

Time-Based Reinforcement

Behavioral psychologist David Premack (1959, 1965, 1971) proposed a unique approach to reinforcement. His probability-differential hypothesis stated that, "For any pair of responses, the more probable one will reinforce the less probable one" (1959, p. 132). Premack's model specified that the value a person places on an activity can be measured by the amount of time spent engaging in the activity, and it held that the reinforcement value of an activity is relative to the value of other activities in the person's repertoire. A middle-valued activity will be a reinforcer for a less valued activity, while at the same time it can be reinforced by another activity which is more highly valued. When used for intervention in human resource management, the Premack model would suggest that an employee would increase performance on the less preferred of two job tasks to gain access to a more preferred job task.

The Premack model has been tested extensively in laboratory and applied experiments (Bernstein & Ebbesen, 1978; Lattal, 1969; Premack, 1971; Schaeffer, Bauermeister & David, 1973; Wasik, 1970; see Timberlake & Farmer-Dougan, 1991, for a comprehensive review). The model has also been mentioned in the organizational behavior modification literature as applicable to human resource management (Luthans & Kreitner, 1985; Podsakoff, 1982) and has been tested in the workplace with employees (Gupton & LeBow, 1971), but it has not been applied to the quality of performance.

Premack's time-based approach to reinforcement has yielded a second generation model, based on homeostatic regulation of the time devoted to activities (Timberlake, 1980; Timberlake and Allison, 1974). In this view, the person encountering a contingency between activities regulates time to restore a restricted activity to its ideal level, regardless of the relative rank order between them. This approach has been used in clinical contexts (Dougher, 1983; Konarski, Johnson, Crowell, & Whitman, 1980), and its increased flexibility makes it ideal for use in an applied setting. The establishment of work contingencies in the present research was based on Timberlake and Allison's (1974) response deprivation inequality, as an extension of Premack's time-based model of reinforcement value. The necessary condition for reinforcement compares two ratios, each dividing target activity performance by level of access for the preferred activity. Using a quality measure for the work activity and a time measure for the rewarding activity preserves the same units on both sides of the inequality, so the response deprivation model can make a prediction of a change in quality, not just in the quantity of time devoted to the target activity. Since the present project demonstrates time-based reinforcement of quality, this characteristic is essential.

METHOD

Subjects

Eight employees were randomly selected from 44 hourly employees at a fast food restaurant who had passed proficiency standards established by its national franchisor. The group included four females (mean age = 20) and four males (mean age = 21), and they had been employed an average of 2 years and 1 month with the franchise chain. One employee had completed some graduate/professional education, six had attended college, and one had not graduated from high school. These eight employees were the focus of the main intervention in the study. The 44 employees from the target restaurant and an additional 144 hourly and managerial employees at similar franchise restaurants operated by the same owner participated in a survey conducted as part of the preparation for the intervention. All research sites were in a medium-sized city typical of the plains region. All participants in surveys and interventions signed forms acknowledging their informed consent to participate voluntarily in the research.

Dependent Variables

Definition of quality in performance. The research team worked with the restaurant manager and assistant manager and viewed franchise films to develop operational definitions of quality performance on all task components. Definitions were developed for the following workstations: product cooking, product construction, frying foods, customer service, food delivery, and beverages. The definitions were based on the criteria in the franchise operations manual, and included only those task components frequently chosen by managerial and hourly employees in the survey of importance described above. The franchisor operations manual included detailed descriptions of 25 to 30 task components involved at each workstation. Each employee had previously demonstrated mastery of these steps (in both written and manual skill tests) to the satisfaction of a manager prior to working at each station.

Assessment of perceived importance of quality components. To make the performance measure most useful for the restaurant, employees were asked to identify those features of each workstation that were most important to the job. A checklist of 10 to 15 of the major component tasks for each workstation was compiled in consultation with managers, and employees were asked to indicate the four most important components of service quality for each workstation. The sample included 42 managerial personnel and 146 hourly employees drawn from nine restaurants operated by the same franchisee. Ratings were obtained about all workstations, but only the categories of Food Delivery and Food Frying were targeted in the present study. Table 1 shows the performance components that were described by employees as important for those two activities. The number of employees identifying each component as important was divided by the total number of responses, yielding an index of relative importance for each component. Table 1 also shows these relative weights, normalized such that the weighting factors sum to 1.00 for each category of performance and rounded to the nearest five percent. Because the task components of maintenance and stocking were essentially identical across workstations, they were constrained to be equal in weight even though the ratings varied slightly. Using typical employee responses as a guide, the weights of those components were set to .025 in all cases, prior to the normalization of the remaining components. Similar analyses and weightings were done for all recorded activities.

Observer training. Observation forms based on the quality performance definitions were fine-tuned by a few researchers, and then the system was explained to 15 undergraduate students receiving academic credit for their participation as observers. Their training began with viewing a videotape of a restaurant supervisor demonstrating all correct procedures for each workstation, along with some common errors. Each segment of the film was followed by a discussion session in groups of three to five observers, and oral competence tests were administered after 6 hr. Once the rationale was mastered, observers practiced making ratings of 20-min video tape samples of uninterrupted performance. Four 20-min tape samples of graduated difficulty were used, and observers began with the easiest segment and progressed to each level of difficulty once 90 percent interrater reliability was reached. Observers were trained on an individual basis, and progress was charted until 90 percent accuracy was demonstrated on the most difficult sample tape. Only those observers who passed the top level of reliability were part of the data collection. Interrater reliability was checked again during the middle of the study period, and observers below the criterion were retrained to criterion before collecting data again.

TABLE 1

Component tasks for calculation of error ratings on target activities; final error ratings are weighted by the percentages for each component, as derived from the employee survey.

Workstation	Component	Weighting
Food Delivery	Courtesy	.30
	Proper delivery of food	.15
	Assembly of package or tray	.15
	Announce that order is ready	.10
	Accuracy of order	.10
	Efficiency	.10
	Maintenance and cleaning	.05
	Stocking material	.05
Frying Food	Maintain supply of fresh products	.55
	Efficiency in preparing portions	.20
	Salt application	.15
	Maintenance and cleaning	.05
	Stocking material	.05

Observation procedure. The trained observers stood in the kitchen area of the restaurant, watching the targeted employee and making notes on a standard observation form. Employees were completely aware both of the presence of the observer and of the nature of the observation plan. The observation system generated raw data on the number of times each observed employee attempted each component task for the workstation and the number of times each component was graded as incorrect. For each component a percentage of errors was calculated using the total numbers per work period. Work periods (job shifts) were only included in the study if the employee was scheduled a minimum of 2 hr, and the employee had to work a particular station 20 min or more for the observation to be included in the study. These criteria were used to limit the analysis to relatively stable work periods, for sometimes employees worked multiple stations during a single shift. Since both managers and hourly employees felt that not all errors were of equal importance, the error rate for a workstation was a weighted combination of the error rates on the individual task components performed at the station, as described above. The individual component error percentages were multiplied by the weightings and summed to yield a single error rating for each work period.

Assessment of preference hierarchy among workstations. Since the Premack model assumes that reinforcement value is found only in activities ranked higher in preference, a preference order among workstations was determined for each employee from self-report questionnaires administered at the study site. Given the impossibility of a baseline period in which all employees chose workstations every shift, a self-report method used previously (Bernstein and Michael, 1990; Bernstein, 1986) assessed employee preferences. Employees were given a list of eight possible work assignments and asked to rank them from highest to lowest (1 = most preferred, 8 = least preferred). Bernstein and Michael (1990) found high correlations between self-reports and the amount of time actually devoted to activities and used the time estimates to construct contingencies. In the intervention stage the quality improvement target was generally selected from those activities at the least preferred end of the ranking, and the assigned workstation offered as a reward was selected from those at the top of the ranking.

Independent Variables

Baseline error rate. Quality performance in this intervention was measured as an improvement in error rate, and occurrences of improvement were rewarded. The definition of improvement was a decrease in the error rate below the level of the first four work shifts of data collection. The average number of errors was computed for each individual at each workstation, and it was used as a reference point for the duration of the study.

Instructions about definitions. As part of the full intervention, employees were reminded about the quality standards for the workstation and were told specifically what would be evaluated. Since the instructions could have an independent effect separate from the contingency, they were given without a contingency for a period of time before the contingency was instituted. Once an employee was targeted for the intervention, the quality standards were read 24 hr before the next scheduled work shift. Although each employee had passed franchise proficiency standards for the targeted and reinforcer workstations, employees often were no longer aware of the detailed standards being used or had altered procedures based on their own experiences. Since the contingency condition would include instructions, this condition was instituted first to separate out the effect of information and attention alone.

Premack-style reinforcement contingency. As noted in the introduction, one of the distinguishing characteristics of Premack's model is the use of access to a preferred activity as a reward. During the contingency condition designated employees were assigned their most preferred workstation for their next shift if their average error rate for the current work shift was improved over their individual baseline error rate for that station. Consistent with Premack's (1965) analysis of a contingency, completion of the required performance produced a period of time in which there were no restrictions on the employee's access to the most preferred activity. Measurement of performance continued during the shifts on preferred workstations, but there was no scheduled consequence for level of performance during that shift.

While Premack's original model required that the designated target activity be measured in amount of time and that it be lower in the hierarchy, the response deprivation position (e.g., Timberlake & Allison, 1974) suggests that preference order is not critical. The present study uses mostly less preferred activities (and one equally preferred) as the required work performance, but we extended the response deprivation formulation to include a quality measure in the instrumental ratio term. For example, if in baseline the employee had an error rating of 20 on product assembly and would like a 4-hr shift on food delivery, the contingency would require a decrease in assembly error rating to 15 in order to have access to a 4-hr workshift on delivery. Following the workshift on the most preferred assignment, the employee was again scheduled at the station targeted for improvement. The employee repeatedly earned access to the most preferred workstation whenever the cumulative error ratings were lower than the preintervention baseline rate. The response deprivation condition was met because time on the preferred workstation was kept below its baseline level unless there was an increase in the quality performance of the target activity.

Experimental Design and Analysis

A multiple baseline within-subject design was used with replications across five employees who experienced the contingency. Each employee had baseline observation, followed by instructions only, and finally a period of the contingency condition. The beginning of the instructions and contingency phases was staggered across employees, with each new intervention attempted at a time when the local performance quality was roughly stable or worsening. Because part-time employees did not work everyday, it was not possible to have every employee represented on every day of observation, so the data are presented as consecutive days of observation for each employee. This means, for example, that the fifth day of observation for Employee A may be an entirely different calendar day from the fifth observation for Employee C and it may follow the fourth day of observation by more than one calendar day. Given that some improvement in quality might occur from observation and practice alone, the performance of three employees served as a control for maturation. The job performance was also overtly monitored throughout the study, but neither instructions nor a contingency was ever implemented.

The performance from each workshift for each employee is reported to allow for inspection of the variability in performance and the overall trends within and between conditions. In addition, the three condition averages are presented as bar graphs to allow for a larger scale evaluation of the outcome of the intervention procedures. For the control employees, the baseline data points are averaged in sequential thirds (as a rough parallel of the three conditions) to show the potential effect of maturation due to observation and general participation. It was expected that instructions on evaluation criteria would produce some improvement, though perhaps transitory, and the full contingency would produce more improvement than instructions alone.

Procedures

The eight designated employees gave informed consent to have their work observed and evaluated at the beginning of the observation period. At no time during this study was there any deception about the nature or purpose of the procedures; observers discouraged conversation when addressed by employees, but managers answered questions about what was being done. As baselines became roughly stable, each of the five employees targeted for improvement was contacted individually about the additional procedures. Before the start of work on the staggered starting dates for the instructions-only condition, one of the researchers read a prepared description of the measurement procedures and the criteria for the particular workstation observed. Before the start of work at the beginning of the contingency condition, employees were told that if they reduced the cumulative error rating that day on the targeted workstation, they would be scheduled to work their most preferred workstation during the next scheduled work period. Prior to punching in on the time clock at the next scheduled work period, the employee was told whether or not the cumulative error rating had changed. If it was reduced, employees were told they had earned the right to work their most preferred workstation that day. If a reduction in error rating had not occurred, employees were again assigned to the targeted station after being read the usual instructions for contingency days. For four of the five interventions the most preferred activity was customer service, and the fifth employee preferred frying foods.

RESULTS

Performance is presented as the weighted error rating for each employee's targeted workstation. The vertical axes of Figures 1, 2, and 3 show the average error rates per work shift for the five employees receiving the intervention; the horizontal axes indicate the number of observation periods, all of which occurred during a 7-week period. The multiple baseline design is shown in the staggered onset of the interventions; the initial baseline periods range

FIGURE 1. Error ratings for Employees D and A during individual work shifts. The onset of the instructions and contingency conditions were staggered following increasing amounts of baseline. Performance was not improving at the time of the intervention changes.

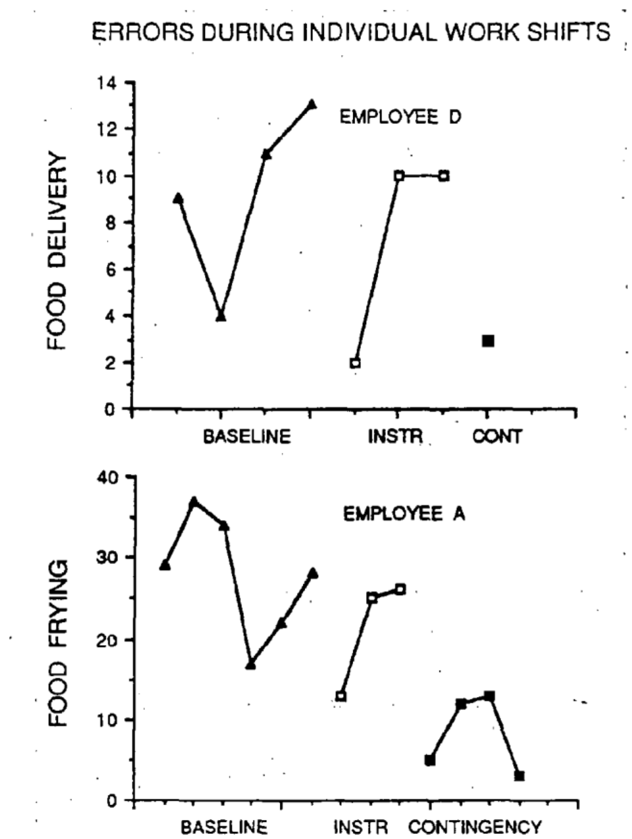


FIGURE 2. Error ratings for Employees B and C during individual work shifts. The onset of the instructions and contingency conditions were staggered following increasing amounts of baseline. Performance was variable at the times of the intervention changes.

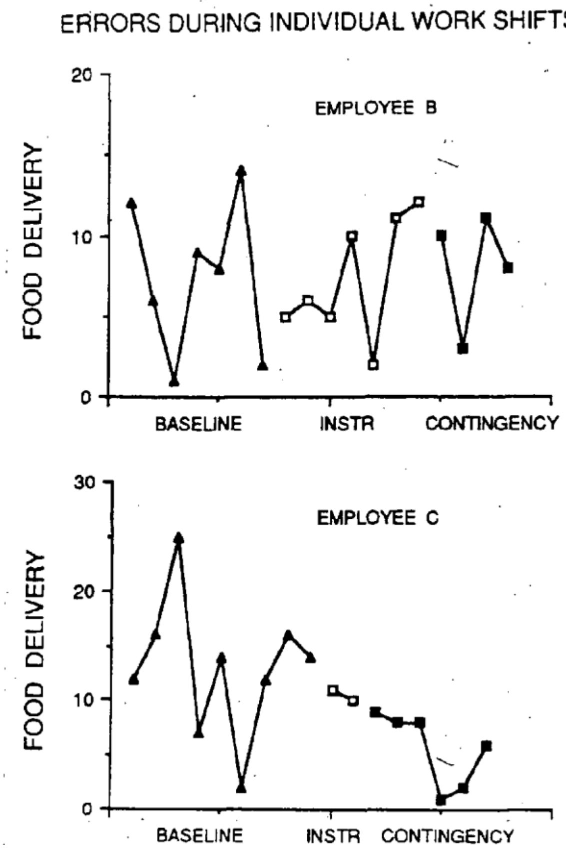
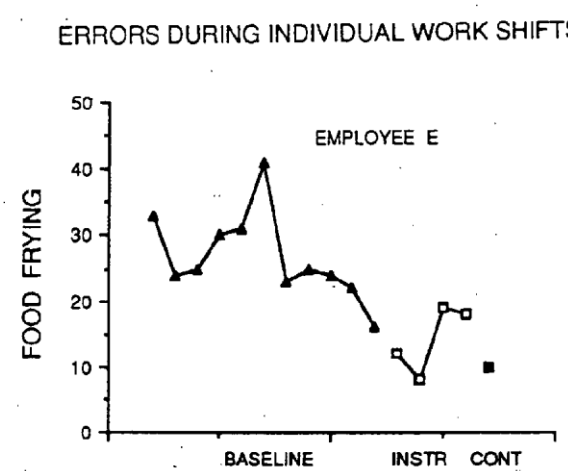


FIGURE 3. Error ratings for Employee E during individual work shifts. The onset of the instructions and contingency conditions followed the longest baseline. Performance was improving at the onset of the instruction condition but was not improving at the onset of the contingency.



from 4 workshifts in the top of Figure 1 to 11 workshifts in Figure 3. Several major features of the data are immediately apparent. First, the overall error rates in the three conditions are consistent with the expectation that instructions would decrease errors, but a contingency would decrease them even more. Second, the day to day variability is substantial. Third, there is an overall trend toward fewer errors as measurement continued over the 7-week period.

The strongest support for the intervention comes from Employee A whose errors on the fryer decreased clearly with each intervention, and the weakest support comes from Employee B whose errors on food delivery seemed virtually unaffected by the procedures. Employees D and E provide modest support, but due to practical problems in execution of the study, each has only one day of the full intervention. Employee C shows a modest decrease due to the contingency, but it is sustained over six workshifts. It is also interesting to note the upward trend in errors within the instruction condition for four employees. It would appear that instructions alone produced a quick decrease in errors, but that improvement disappears equally quickly.

There were some consistent trends in the data that become apparent when daily observations are aggregated into condition averages. Figures 4, 5, and 6 show the average error rating for the baseline, instructions, and full contingency conditions for the five employees who received the intervention. The four employees in Figures 4 and 5 show a consistent pattern in which the error rate in the instructions condition is lower than in baseline and the error rate under the contingency is lower than in either baseline or instructions conditions. Figure 6 shows the data from Employee B, whose error rate declined only slightly in the contingency condition. The probability of observing nine predicted outcomes out of ten binary cases is less than .05. In the big picture, the intervention seems to have had some impact on employee behavior, even if there is still substantial variability day to day.

By contrast, Figures 7 and 8 show the average error rating for sequential thirds of the baseline observations made of the three control employees. These data come from samples taken over the same period as the experimental data, and they show trends from three employees whose performance was only observed and recorded. These control data reveal no consistent downward trend in error rates for activities and employees not targeted for instructions and contingencies, and there are no patterns across employees of systematic decrease such as the one found with the other five employees. The middle third was higher than the first third in two of four instances and lower in two, and the final third was higher than the first and middle thirds in two of four instances and lower in two.

Although all employees eventually lowered their error ratings and gained access to the reinforcer workstation, individual response time varied. Three of the five employees (A, D, and E) responded immediately and consistently when the contingency was applied; their cumulative error rating on the targeted workstation decreased, earning them access to their preferred station. Employee C showed slight initial improvement, and it wasn't until the fourth contingency day that the error rating decreased substantially. The increase of the Employee C's error rating during the final workshift resulted from an unplanned return to the baseline condition. Assignment to the preferred station was not made due to an employee shortage that evening, and performance quality was recorded even though he did not receive the preferred workstation. Employee B earned access to the preferred assignment on the second day of the contingency, but the error rating jumped back up the following day. Similar to Employee C, Employee B had an unplanned return to baseline due to employee scheduling restrictions. Both of these interruptions highlight the difficulty of applying laboratory-based procedures in field settings.

FIGURE 4. Error ratings for Employees A and C aggregated across experimental conditions. A change in the predicted direction occurred for all four changes in conditions.

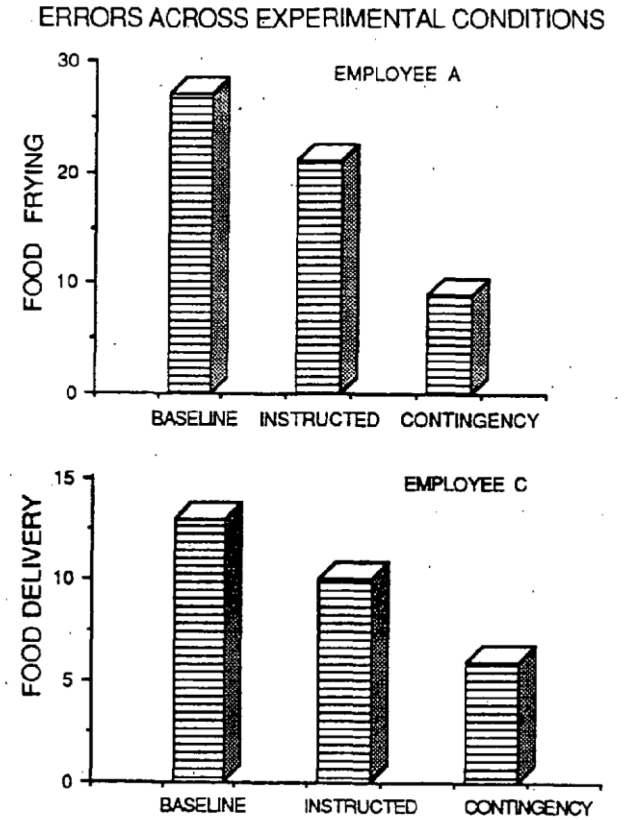


FIGURE 5. Error ratings for Employees D and E aggregated across experimental conditions. A change in the predicted direction occurred for all four changes in conditions.

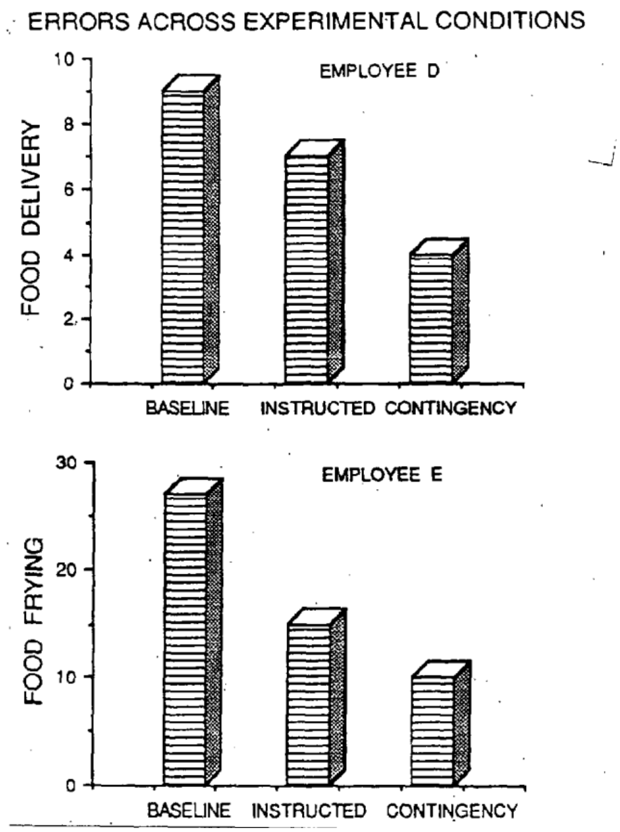


FIGURE 6. Error ratings for Employee B aggregated across experimental conditions. A change in the predicted direction occurred only for the second change in conditions.

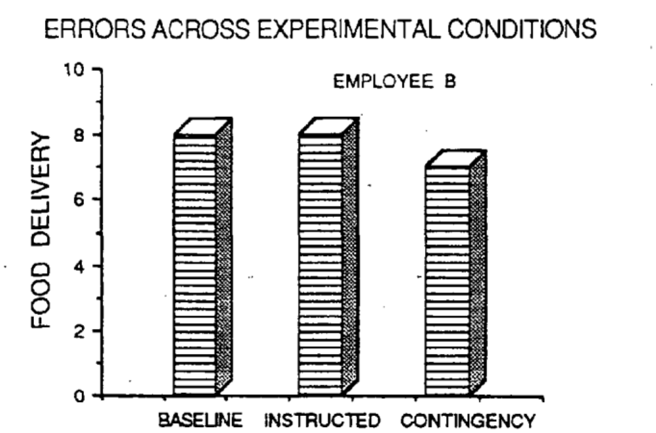


FIGURE 7. Error ratings for control Employees F and G aggregated across thirds of the experimental period. A change similar to that observed with the intervention occurred in only two of the four changes in conditions.

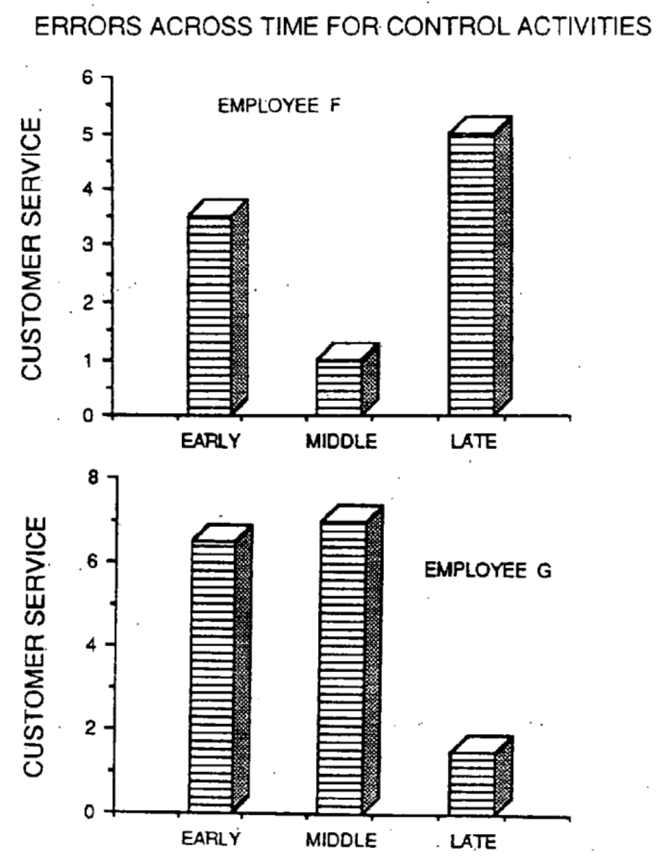
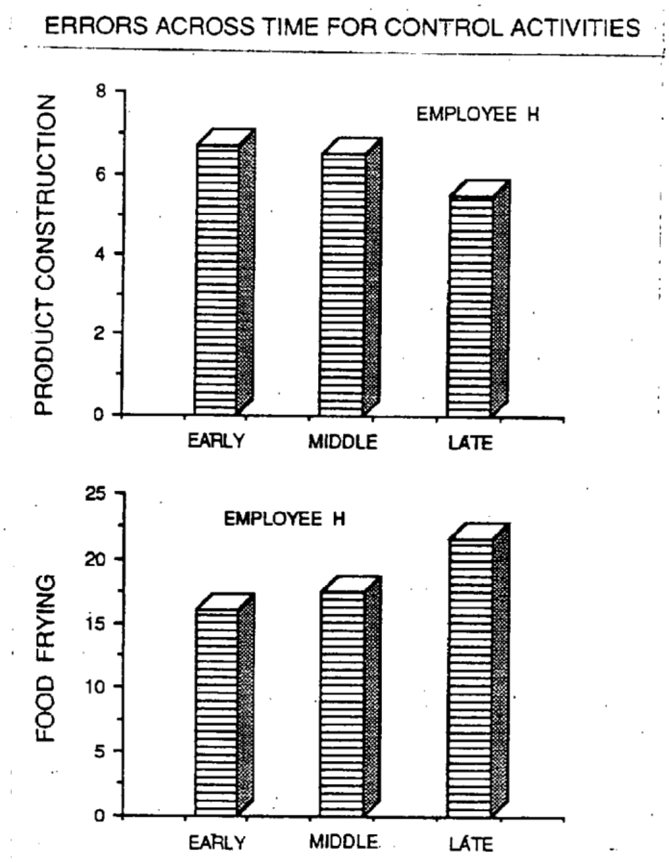


FIGURE 8. Error ratings for two activities of control Employee H aggregated across thirds of the experimental period. A change similar to that observed with the intervention occurred in only two of the four changes in conditions.



DISCUSSION

The results of this application of a Premack-style contingency in a field setting seem promising. There is clear evidence that the interventions had an impact on the quality performance of employees in a fast food restaurant, though the size of that impact was modest when compared with laboratory studies using similar procedures (Bernstein & Brady, 1986; Bernstein & Ebbesen, 1978). In the present circumstances, it was not possible to have the amount of control over activities that is available in the laboratory, and the variability in performance is much greater because employees are not on the job all day or even every day.

When designing management programs using access to activities as a reward, there are advantages to the response deprivation position offered by Timberlake and Allison (1974) as an extension of Premack's (1965) original conception of time-based reinforcement. Whereas Premack's version would limit the workstations available for use in contingencies, the response deprivation model recognizes the value inherent in all the activities. Contingencies can be successfully arranged between any pair of activities and even between two versions of the same activity, as was done with Employee E in the present study. That kind of procedure takes advantage of the if-and-only-if provision of a contingency operation specified by Premack; Employee E could only stay on his favorite workstation if he exceeded the quality standard.

The effects of instruction found in the present research could use additional study. The transitory decreases in error rate that followed from instructions for four of the five experimental employees could have been due to the Hawthorne Effect, to lack of prior training, or to other causes. Identification of the source of this decrease in errors could add another tool for raising quality performance.

The ultimate test of the usefulness of Premack-style contingencies will be in whether managers are able to apply it in daily work situations. One implementation problem in the present procedure is the labor-intensive observation system; managers can't spend all day watching and counting every task component, and hiring observation staff would wipe out any gains in productivity from the overall program. Some form of reliable time sampling technique is needed, along with simplified procedures for administering the contingencies. Luthans, Paul, and Baker (1981) and Luthans, Paul, and Taylor (1985) used time sampling techniques while implementing reinforcement interventions in the workplace. Working in a fast food restaurant, Krueger and Bernstein (1990) compared 10-min and 20-min time samples with complete records such as the ones used in the present study, and found that 20-min samples gave data on quality very similar to the data from full 2 hr samples of observation. On a more conceptual level, there is a need for analysis of the constraints on scheduling employees to see if there are enough degrees of freedom in a typical schedule to allow widespread use of this kind of procedure. If administered poorly and used on a daily basis, the present observation and intervention procedures could generate considerable confusion.

Another aspect of contingencies on quality that needs more research is extended maintenance of improved performance. The present study did not include extended durations of the intervention, and given the transitory effects of the instructions, it is possible that the contingency gains might not last either. Perhaps with the present data available, managers will commit sufficient time and scheduling resources to this project so that an extended test of the contingencies can be undertaken.

The present data on errors used a weighting system that combined different kinds of errors into a single error percentage for each workstation. The particular weighting strategy (driven by manager and employee perceptions of importance) may not be ideal for all applications, but it represented an attempt to maximize the external validity of the results. It would be of little use to a manager if the researchers produce a big change in behavior that is of minor importance on the job site. By having employee feedback determine the weights, we were at least assured that the results would be significant for those who would be likely to use them. While there may be some effect on the data as a result of this transformation, the effect was constant across the whole study and could not have influenced the substantive nature of the conclusions reached.

This study should be used as a point of departure. The results indicate that Premack-style reinforcement procedures may offer an alternative to direct financial incentives as a potential solution to the quality or productivity problems in the service sector. The present study has not provided a complete set of guidelines for ready implementation of this approach in any business setting. Given the limits on control that were inherent in conducting the research in a functioning business, however, the results are sufficiently promising to merit continued research effort on refinements and extensions in business settings.

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