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EXPERIMENT

The Search for the Optimum Individual Monetary Incentive Pay System: A Comparison of the Effects of Flat Pay and Linear and Non-Linear Incentive Pay Systems on Worker Productivity

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ABSTRACT. This study continued the search for the optimum individual monetary incentive pay system by investigating the effects of a flat pay system and three individual incentive pay systems (linear, positively accelerating and negatively accelerating) on worker productivity. Four experiments were conducted using a within-subject, multiple-baseline design. Experiment 1 was a systematic replication of the earlier work of Oah and Dickinson (1992) and Experiments 2, 3 and 4 were systematic replications of each other with different questions being asked about the efficacy of the three incentive pay systems. In each experiment, the subjects worked in groups, ranging in size from four to six members, and were exposed to the flat pay system and to one of the incentive pay systems while engaged in a simple production task. Subjects participated in twenty (Experiment 1 and 2) to twenty-five (Experiment 3 and 4) fifteen-minute sessions. The production task consisted of constructing “widgets” from pop beads. The primary dependent variables were the number of correctly made widgets per work session and the cost-per-widget. The four experiments produced mixed results with respect to widget productivity and cost-per-widget; however, there were two consistent findings. A systematic relationship between pay and productivity emerged in that, with all four experiments, the incentive pay systems generated higher levels of productivity than did the flat pay system. Also, the three incentive pay systems differentially affected performance levels and cost-per-widget. Across the four experiments, the negatively accelerating pay system emerged as the most reasonable option for pay system designers. This finding suggests that it is not the size of the incentive which controls performance, but rather the fact that there was a pay-for-performance contingency in place. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-342-9678. E-mail address: getinfo@haworth.com]

Performance of individual workers is critical to making organizations work effectively (Gilbert, 1978; Lawler, 1990). Furthermore, since labor costs can account for 60-80 percent of an organization's total operating costs (Blinder, 1990; Perry, 1988), the ability to manage performance improvements and to maintain consistent performance over time may well determine an organization's success or failure. However, the management of individual performance affects more than the single organization. The United States' current economic position, prompted by the reduction in the average annual productivity growth rate and a decline in the competitiveness of U.S. industries in the world market (Blinder, 1990; Grayson & O'Dell, 1988; Lawler, 1990) is good reason to consider performance management an urgent issue. "From 1973 to 1988 output per worker-hour in all U.S. businesses grew at a paltry compound rate of 1.05 percent a year.
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That is barely more than a third of the growth rate we enjoyed during the halcyon 1947-73 period (2.96 percent a year) and, more important, only about half our long-term historic average” (Blinder, 1990, p. 1). In terms of global competitiveness, average productivity growth between 1960 and 1980 was 2.7 percent for the U.S. compared to 9.3 percent for Japan (Mainstone & Levi, 1987). This downward trend in productivity growth does not merely affect U.S. economic standing in the world market; it produces an adverse impact on the living standards of all U.S. citizens. Blinder (1990) eloquently addressed this point when stating that: “If our productivity growth rate remains so depressed for a protracted period of time, America is destined to slip into the second rank of nations in terms of wealth and income, just as the United Kingdom did before us. To most Americans, that is a distasteful prospect” (p. 1).

Although recent efforts to improve productivity and to place America in a more favorable economic position have found companies increasingly turning to monetary incentive systems (Lawler, 1990; Perry, 1988; Skryzcki, 1987; Weitzman & Kruse, 1990), the use of monetary incentives is not a new phenomenon. Peach and Wren (1992) point out that incentive pay is cited in the Code of Hammurabi, and throughout recorded history contemporary researchers have a detailed analysis of monetary incentive plans.

Modern incentive systems have taken several forms such as profit sharing, gain sharing, pay for skills and knowledge, merit pay, and lump-sum bonuses (Abernathy, 1990; Blinder, 1990; Jenkins & Gupta, 1982; Perry, 1988). According to Agnew, Dickinson, Acker, and Cronin (1992), these incentive plans are only marginally effective at changing organizational behavior because they violate a basic behavioral principle relevant to pay-for-performance. As specified by Bijou and Baer (1978) and Frederiksen (1982), to derive the greatest benefit from monetary incentive systems, money should be delivered contingent upon clearly defined, individual behavior as soon after the behavior as possible. Thus, the limitation is, at least, partially attributed to the considerable delay in the delivery of the money incentive which is inherent in profit sharing, gain sharing, and lump-sum bonuses, and to unclear antecedent performance requirements. Agnew et al. (1992) suggest that a monetary incentive system which conforms to these behavioral principles is better at managing and maintaining performance improvements over time and define the optimal incentive pay system as an “...individual monetary incentive system involving the timely delivery of money contingent upon individualized, overt work performance” (p. 1).

Lawler (1990) has suggested another variable that defines a good mon-
etary incentive system. When pay is contingent upon performance, the individual must be able to directly influence his or her performance measure through behavior. Lawler (1990) refers to this control as "line of sight or line of influence." In other words, pay should be directly linked to individual performance.

Individual monetary incentive pay systems, consistent with the recommendations of Agnew et al. (1992) and Lawler (1990), have been effective in managing worker productivity in the laboratory (Agnew et al., 1992; Frisch & Dickinson, 1990; Johnstone et al., 1989; Leary et al., 1990; Oah & Dickinson, 1992; Smoot, Jones, Brutsche et al., 1991; Smoot, Jones, Lynch et al., 1991; Smoot, Naylor, & Carre', 1992; Stoneman & Dickinson, 1989) and in applied settings (Abernathy, Duffy, & O'Brien, 1982; Gaetani, Hoxeng, & Austin, 1985; George & Hopkins, 1989; Nebeker & Neuberger, 1985; Petty, Singleton & Connell, 1992; Wagner, Rubin, & Callahan, 1988). A general finding among these studies is that workers tend to perform at higher levels when they are paid for what they produce as opposed to being paid for merely showing up for work (salary). When pay is tied to performance and workers know there is a direct relationship between their productivity and their pay level (there is a short line of sight), individual performance is better.

Investigations of the performance-pay contingency have analyzed such factors as pay curve design, different percentages of incentive pay to base pay, group versus individual payout conditions, and group size. Oah and Dickinson (1992) and Stoneman and Dickinson (1989) reported no significant difference in productivity as a function of: (1) percentage of incentive pay to base pay, (2) group incentives versus individual incentives, and (3) size of work group. Replications by Johnstone et al. (1989) and Leary et al. (1990) reported similar findings. Studies by Dickinson, LaMere, and Biby (1991), Frisch and Dickinson (1990), and Riedel, Nebeker, and Cooper (1988) reported that performance was comparable under different percentages of incentive pay. In an investigation of pay curve design, Oah and Dickinson (1992) reported that productivity was not differentially affected by a linearly increasing and a positively accelerating incentive pay system. One finding consistent across all these studies was that incentive pay controlled higher levels of productivity than hourly pay. However, the results left many questions about the optimal incentive pay system unanswered. The studies presented here attempted to pose some of those questions and provide answers.

A series of four laboratory studies was conducted in which independent variables were systematically varied to answer a number of practical questions about the characteristics of the optimum individual monetary incen-
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tive pay system. The initial study in the series extended the earlier work of Oah and Dickinson (1992) who investigated the effects of a linear and a non-linear, positively accelerating pay system on worker productivity. The first study extends the Oah and Dickinson work by adding an additional nonlinear pay system. The next three studies were progressive extensions with the findings of each study providing a basis for further refinements of the experimental question.

The second study included pay systems identical to those employed in the first study, but was expanded to include a manipulation of feedback. The role of performance feedback in the optimum incentive pay system is well worth investigation given that feedback often yields positive effects on worker performance (e.g., Brown, Willis & Reid, 1981; Dierks & McNally, 1987; Gaetani, Hoxeng & Austin, 1985; Karan & Kopelman, 1987; Kim, 1984; Lamal & Benfield, 1978; Silva, Duncan & Doudna, 1982). Research has shown that feedback is effective in improving performance when given alone (e.g., Babcock, Sulzer-Azaroff, & Sanderson, 1992; DeVries, Bumette, & Redmon, 1991; Parsons, Cash, & Reid, 1989) and in combination with monetary incentives (e.g., Abernathy, Duffy, & O'Brien, 1982; Dierks & McNally, 1987; Gaetani, Hoxeng, & Austin, 1985; Haynes, Pine, & Fitch, 1982). Balcazar, Hopkins, and Suarez (1986) suggest that performance feedback may have a supplemental effect on performance when used in conjunction with differential consequences, such as those arising from monetary incentives. However, the supplemental effects of feedback on performance beyond improvements derived from the individual monetary incentive systems had yet to be experimentally investigated. The studies demonstrating positive results from combining feedback with monetary incentives have typically introduced the feedback manipulation prior to the introduction of the incentive pay system (e.g., Dierks & McNally, 1987; Gaetani, Hoxeng, & Austin, 1986). With such an experimental design, it is not possible to determine the supplemental effects of feedback. The second study in the series investigates the supplemental effect suggested by Balcazar et al. (1986) by introducing the incentive system with formal feedback for one group in each of the three incentive pay systems and then removing the feedback manipulation in the final experimental phase for those groups. For the other three groups, the incentive pay system was introduced with the feedback manipulation but no reversal of the feedback manipulation was performed.

The third study extended the second through the addition of a work setting manipulation to assess the effects of the presence of others on productivity when an incentive pay system is operative. Investigations of
the pay-performance contingency have assessed the effects of individual versus group incentives and the effects of incentives on worker performance in various sized groups (Stoneman & Dickinson, 1989). However, the effects of the mere presence of other workers on productivity levels when a monetary incentive system is operative has not been empirically investigated by behavior analysts.

The fourth study directly replicated (Sidman, 1960) the third study and added the calculation of the percentage of incentive to base pay earned by subjects. Fein (1970) and Henderson (1985) suggested that incentive pay below 30% of base pay would be ineffective in producing productivity increases, and that incentive pay levels above 30% of base pay will not result in any significant increases above the 30% incentive-to-base pay level. Research on monetary incentive systems involving incentive-to-base pay (Frisch & Dickinson, 1990; Dickinson & Gillette 1993; Dickinson, LaMere & Biby, 1991; Leary et al., 1989) consistently demonstrate that those receiving incentive pay performed significantly better than subjects who received an hourly wage, and that incentives as low as 3% (Frisch & Dickinson, 1990; Dickinson et al., 1993) produce substantial increases. However, in all studies subjects performed comparably and there was virtually no difference in performance improvements when subjects were paid incentive-to-base pay rates ranging from 3% to 100%. Calculation of the incentive-to-base pay in the fourth study was intended to provide additional information in clarifying the functional relationship between pay level and performance in light of the assertions made by Fein (1970) and Henderson (1985).

The growing body of literature on individual monetary incentive systems (e.g., Bushhouse, Feeney, Dickinson, & O'Brien, 1982; Farr, 1976; Gaetani, Hoxeng, & Austin, 1985; Johnstone et al., 1989; McNally, 1988; Orpen, 1982) suggests that the optimum incentive system is instrumental in controlling desired levels of productivity and quality over time, performance variability, cost effectiveness, and worker absenteeism. Productivity levels, performance variability, and cost effectiveness have been emphasized in all studies in the series. However, the final study differed from studies 1 through 3 in that the research question was expanded to assess the collateral effects of the incentive systems on quality of work and absenteeism. Previous research (Adam, 1972, 1975; Adam & Scott, 1971) has shown an inverse relationship between quantity and quality. Therefore, the effect of increases in productivity on product quality was also assessed.
GENERAL METHOD

Subjects

Subjects naive to pay-for-performance were recruited from Introductory Psychology classes at a northeastern university. Subjects were recruited through two methods: scheduled visits to classrooms and recruiting flyers with sign-up sheets posted in the psychology department. Subjects were paid cash for their participation and those completing the study received credit for fulfilling a Psychology Department research participation requirement. Subjects with three or more unexcused absences were permitted to continue the study but they were not given the two research credits. Prior to beginning the study, subjects were required to sign a consent form.

Setting and Apparatus

The study was conducted in three rooms and nine individual cubicles in an experimental laboratory in the Psychology Department. The rooms and cubicles were equipped with a work table and chairs.

Work Task and Dependent Variable

Subjects engaged in a production task constructing “widgets” from pop beads. A pop bead is a spherical object approximately 2.5 centimeters in circumference with a small hole on one side and a small nipple on the other side. A “widget” consisted of sixteen plastic pop beads joined together in a circle arranged in a pattern of eight white, four blue, and four purple pop beads. Each individual and group were provided with an equal number of pop bead containers.

The two primary dependent variables remained constant across all four studies. They were the number of correct widgets produced in each experimental session and the cost per widget for each pay system.

Independent Variable

The independent variables were the system by which subjects were paid. Four pay systems were assessed: Flat Pay, Linear, Positively and Negatively Accelerating.

Flat Pay System. Subjects received a flat rate of pay per work session regardless of the total number of widgets produced, provided subjects produced at least ten widgets. The amount of flat pay was not the same for all four studies.
Linear Pay System. Subjects were paid on a piece-rate basis and received $0.10 for each correct widget produced.

Positively Accelerating Pay System. Subjects were paid on a piece-rate basis and received incrementally more pay for each additional widget produced.

Negatively Accelerating Pay System. Subjects were paid on a piece-rate basis and received incrementally less for each additional widget produced.

The total amount of money subjects could earn for producing widgets under the three incentive pay systems is provided in Appendix A and the pay curves for three systems are presented graphically in Appendix B.

Experimental Design

A within-subject, multiple baseline design (Barlow & Hersen, 1984; Johnston & Pennypacker, 1980; Komaki, 1982) was adopted to assess the independent variables. Subjects were randomly assigned to six experimental groups. Each group was randomly assigned to one of the three incentive pay systems resulting in two groups paid under each system.

Subjects participated in work sessions of fifteen-minutes duration. Sessions were held at regularly scheduled times on Mondays, Wednesdays, and Fridays. Subjects were required to attend the same time slot for each session.

All group/subjects began in the baseline phase in which they received flat pay for each session provided they produced at least ten correct widgets. When productivity stabilized in the baseline phase, the incentive pay phase was introduced. The criterion for stability was that at least three consecutive work sessions had to occur in which widget production did not vary more than 5% over mean productivity of the three sessions, or where a downward trend in productivity was observed. Both individual and group data were considered in determining performance stability.

Procedures

The relevance of laboratory investigations for human behavior in applied settings depends, in part, on the degree to which the applied and laboratory settings are functionally analogous. Therefore, the laboratory environment was designed to simulate, as much as possible, the environment of a real work setting. First, the production task of constructing widgets is not unlike piece work. Second, subjects were required to report to work sessions at a specific time three days per week and to produce a minimum amount of work to receive any pay. All pay systems had a base production requirement of ten widgets. Subjects who produced fewer than
ten widgets in a session, regardless of the pay system in place, received no pay for the session. Third, subjects arriving late to work were permitted to enter the work session but they were neither systematically penalized for tardiness nor given extra work time. However, there was a naturally occurring penalty in that subjects arriving late typically produced fewer widgets, thereby earning less pay in the incentive conditions and no pay in the baseline condition if productivity fell below the base requirement. Fourth, actual work settings offer competitive sources of reinforcement for off-task (nonwork) behaviors such as interaction with co-workers, phone calls, and reading, but not all workers have the opportunity to engage in alternative behaviors. While competitive sources of reinforcement were not explicitly manipulated in any of the four studies, subjects were not prohibited from engaging in off-task activities. For example, subjects were permitted to bring reading materials, food and any other items into the work sessions. And, subjects could simply show up for work and engage in other activities during the session without making any widgets. Fifth, subjects were required to sign a form verifying the number of widgets produced and the amount earned per work session. This verification served much the same purpose as an employee’s signature on a time card.

Prior to the beginning of the first work session, experimenters read standard instructions on how the work sessions would be conducted and on how subjects would be paid. This was followed by a demonstration on the construction of a correct widget. Each work session was conducted in the following manner. At the beginning of the work session, an experimenter read instructions on the pay condition in effect for that day. Next, the experimenter instructed subjects to begin working and simultaneously began a stop watch. The experimenter left the room while subjects worked. Subjects assembled widgets for fifteen minutes and were then instructed by the experimenter to discontinue working. At the end of the work session, the experimenter, in the presence of the subjects, checked the widgets for correctness and recorded the number of correct widgets on the subject’s daily productivity record. The experimenter then calculated and recorded the amount of pay the subject earned for the session, and secured the subject’s signature verifying agreement with the entries on the productivity record. Finally, the subject was paid for work performed at the previous session and then dismissed.

**Intervention Integrity**

The primary investigator addressed intervention integrity in two ways. First, research assistants were trained in proper research techniques with particular emphasis on the necessity of standardization and consistency of
instructions and treatment delivery. Second, on a random basis, the primary experimenter observed the behavior of research assistants as they conducted the work sessions.

EXPERIMENT 1

Experiment 1 extended the Oah and Dickinson (1992) study which indicated that productivity is not differentially affected by a linearly increasing and positively accelerating incentive pay system. While Oah and Dickinson assessed the effects of one nonlinear incentive pay system on worker productivity, this study included two nonlinear systems, a positively and a negatively accelerating pay system. And, this initial study employed a within-subjects design to investigate the effects of three incentive systems, whereas Oah and Dickinson used a between-subject design.

METHOD

Subjects

Subjects were 30 college students who were randomly assigned to 6 experimental groups containing 5 subjects each. Five subjects, one each from both positively accelerating groups, two from a negatively accelerating group, and one from a linear group, failed to complete the study. Therefore, the data are based on the performance records of twenty-five subjects.

Independent Variable

During the baseline flat pay condition subjects were paid $2.00 per work session regardless of the total number of widgets produced provided they made at least 10 correct widgets. The linear and positively and negatively accelerating incentive pay systems were introduced as described above.

Experimental Design

Subjects were required to participate in twenty 15-minute work sessions.
RESULTS

Figures 1 through 6 display the mean number of widgets produced per session by groups and by typical subjects in each group in the flat and incentive pay conditions. Table 1 summarizes the absolute change in mean and cost-per-widget and Table 2 displays a summary of the percent of change in mean widget productivity and cost-per-widget.

Number of Widgets Produced

Linear Groups. Figure 1 presents the data for the two groups that changed from the flat pay condition to the linear incentive pay condition. A slight increase in productivity occurred in the linear condition in group 1. Mean widget production improved from 21.1 in baseline to 24.1 for a 14.2% increase over the flat pay condition. In group 2, a more substantial increase occurred. Mean productivity increased from 20.3 in the flat condition to 30.3 in the linear condition representing a 49.3% increase over flat pay. In terms of performance variability, there was greater variability during the flat condition for groups 1 and 2 than during the incentive pay conditions. Performance in both groups was relatively stable during the linear pay condition, however, there was slightly more variability in group 1 than in group 2.

Figure 2 displays the data of typical subjects in groups 1 and 2. Subjects 1 and 2 were most representative of the productivity and variability trends observed in the group data. Although the 27.3 mean for subject 1 was 13.2% higher than the group mean and the mean of 26.3 for subject 2 was 13.2% lower than the group mean, the trends after the introduction of the experimental phases tracked the group data.

Positively Accelerating Groups. Figure 3 presents the data for the two groups that changed from the flat pay condition to the positively accelerating pay condition. After the incentive pay condition was introduced, widget productivity increased from 21.8 to 27.3 in group 3 for a mean difference of 29.2%, and from 21.0 to 24.4 in group 4 representing a 16.2% increase. For group 3, performance variability was relatively the same in the flat and positively accelerating pay conditions. For group 4, variability was considerably greater during the positively accelerating pay condition than in the flat pay condition. A comparison of the two groups shows variability to be greater in group 4.

Figure 4 presents the data for typical subjects in groups 3 and 4. Subjects 3 and 4 were most representative of the group data in terms of overall productivity and variability trends. However, mean productivity of 23.9 for subject 3 is 12.5% lower than the group mean.
FIGURE 1. The mean number of widgets produced per session by groups in Experiment 1 who were exposed to the Linear incentive pay system.
FIGURE 2. The mean number of widgets produced per session by typical subjects in groups 1 and 2 in Experiment 1 who were exposed to the Linear incentive pay system.
FIGURE 3. The mean number of widgets produced per session by groups in Experiment 1 who were exposed to the Positively Accelerating incentive pay system.
FIGURE 4. The mean number of widgets produced per session by typical subjects in groups 3 and 4 in Experiment 1 who were exposed to the Positively Accelerating incentive pay system.
TABLE 1. Absolute Change in Mean Widget Productivity and Cost per Widget in Experiment 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>Flat Pay Condition</th>
<th>Incentive Pay Condition # 1</th>
<th>Incentive Pay Condition # 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear # 1</td>
<td>M = 21.1</td>
<td>M = 24.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CPW = .095</td>
<td>CPW = .10</td>
<td></td>
</tr>
<tr>
<td>Linear # 2</td>
<td>M = 20.3</td>
<td>M = 30.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CPW = .099</td>
<td>CPW = .10</td>
<td></td>
</tr>
<tr>
<td>Positively Accelerating # 3</td>
<td>M = 21.8</td>
<td>M = 27.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CPW = .09</td>
<td>CPW = .12</td>
<td></td>
</tr>
<tr>
<td>Positively Accelerating # 4</td>
<td>M = 21.0</td>
<td>M = 24.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CPW = .10</td>
<td>CPW = .11</td>
<td></td>
</tr>
<tr>
<td>Negatively Accelerating # 5</td>
<td>M = 22.1</td>
<td>M = 26.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CPW = .09</td>
<td>CPW = .05</td>
<td></td>
</tr>
<tr>
<td>Negatively Accelerating # 6</td>
<td>M = 17.8</td>
<td>M = 17.0</td>
<td>M = 16.8</td>
</tr>
<tr>
<td></td>
<td>CPW = .11</td>
<td>CPW = .11</td>
<td>CPW = .11</td>
</tr>
</tbody>
</table>

CPW = Cost per Widget

TABLE 2. Percent Change in Mean Widget Productivity and Cost per Widget in Experiment 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>Percent Productivity Change in Incentive Condition</th>
<th>Percent Cost per Widget Change in Incentive Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear # 1</td>
<td>14.2%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Linear # 2</td>
<td>49.3%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Positively Accelerating # 3</td>
<td>29.2%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Positively Accelerating # 4</td>
<td>16.2%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Negatively Accelerating # 5</td>
<td>19.0%</td>
<td>-44.4%</td>
</tr>
<tr>
<td>Negatively Accelerating # 6</td>
<td>4.5%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Negatively Accelerating Groups. Figure 5 displays the data for the two groups that changed to the negatively accelerating pay condition. Productivity in group 5 improved by 19.0% going from 22.1 to 26.3 after the introduction of the negatively accelerating pay condition. However, variability increased substantially during the incentive pay condition. For group
FIGURE 5. The mean number of widgets produced per session by groups in Experiment 1 who were exposed to the Negatively Accelerating incentive pay system.
FIGURE 6. The mean number of widgets produced per session by a typical subject in group 5 in Experiment 1 who was exposed to the Negatively Accelerating incentive pay system.

6, there was a slight decrease of 4.5% after the introduction of the incentive pay condition with mean productivity declining from 17.8 to 17.0. An additional change was made in group 6, the introduction of the positively accelerating pay condition for seven sessions, with no apparent effect on productivity. Only the data on widget production for the flat and negatively accelerating pay conditions for this group are reported hereafter.

Figure 6 displays the data for a typical subject in group 5. The performance of subject 5 is most typical of the group data with respect to productivity means, pattern of variability, and trends after the introduction of the incentive conditions. Because there were only two subjects in group 6 (two subjects dropped during the study), the presentation of typical data is inappropriate for group 6.

Cost per Widget

Linear Groups. The mean cost per widget was .095 and .099 for groups 1 and 2, respectively. Because of the pay system design, the cost per widget during the linear pay condition was .10. There was essentially no change in cost per widget between the flat and linear pay conditions.

Positively Accelerating Groups. The mean cost per widget during the flat system was .09 for group 3 and .10 for group 4. During the positively
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Accelerating condition, mean cost per widget was .12 for group 3, representing a 33.3% increase, and for group 4 mean cost per widget increased from .10 to .11 for a 10% increase.

Negatively Accelerating Groups. For groups 5 and 6, the mean cost per widget during the flat pay condition was .09 and .11, respectively, and during the negatively accelerating condition the mean cost was .05 and .11 per widget. For group 5, the change in cost represented a 44.4% decrease. No change in mean cost per widget occurred in group 6.

DISCUSSION

Clearly, the incentive pay system controlled higher rates of productivity than the flat pay system in 5 of the 6 groups, although the three incentive systems differentially affected productivity levels and cost per widget. In terms of widgets produced, the data suggest that the linear system is best because the overall mean increase of 31.73% was larger than that of the positively accelerating groups (22.7%) and the negatively accelerating groups (7.25%). In terms of cost per widget, the data show that the linear system produced no change in mean cost compared to the flat pay system. The positively accelerating system created a mean increase in cost per widget of 21.7%. In contrast, the negatively accelerating system produced a mean decrease of 44.4% in cost per widget (although this decrease occurred only in group 5 which showed an increase in productivity—group 6 showed no change in cost per widget and a small decrease in productivity).

The productivity and cost data taken together suggest that the linear pay system was the most effective and that the negatively accelerating system may be a reasonable option. The linear system created an increase in overall productivity mean (27.2 widgets per session) without producing any increase in cost per widget. Whereas the positively accelerating system created an overall increase in mean to 25.6 widgets per session, this increase was offset by the 21.7% increase in mean cost per widget. The negatively accelerating system, at least for one group, produced a 19.0% increase in productivity to 26.3 widgets per session, with a 44.4% decrease in cost per widget.

EXPERIMENT 2

Experiment 2 was a systematic replication of Experiment 1 in that while the three incentive pay systems were identical, the amount paid per
session during the flat pay condition was decreased by $.50 and an immediate feedback manipulation was added. Because hourly pay systems fluctuate across organizations, it is useful to investigate the efficacy of various levels of flat pay when attempting to uncover the essential aspects of the optimal individual incentive pay system. The inclusion of the feedback variable was designed to investigate the efficacy of the three incentive pay systems in combination with feedback. The withdrawal of the feedback manipulation in the last phase of the study was designed to investigate the supplemental effects of feedback on the effectiveness of the incentive systems. The feedback manipulation consisted of subjects recording each widget made during the incentive with feedback phase. Subjects were given a copy of the incentive pay scale which contained blank spaces beside each dollar amount. Each dollar amount represented the cumulative total amount earned for a certain number of widgets. After making each widget, subjects would place a check mark beside the dollar amount corresponding to the total number of widgets the subject had made to that point in the session.

METHOD

Subjects

Subjects were 30 college students who were randomly assigned to 6 experimental groups containing 5 subjects each. Three subjects, one from a positively accelerating group and one each from the negatively accelerating groups, failed to complete the study. Therefore, the data are based on the performance records of 27 subjects.

Work Task

The work task was identical to the widget-making task employed in experiment 1.

Independent Variable

The pay system by which subjects were paid for each work session and performance feedback served as the independent variables. During the baseline flat pay condition subjects were paid $1.50 per work session regardless of the number of widgets produced provided the minimum of 10 widgets was met.
**Experimental Design**

A within-subjects, multiple-baseline with reversal design was employed. As with experiment 1, the within-subjects manipulation consisted of all subjects within a group being exposed to all relevant levels of the independent variables. The multiple-baseline design was achieved by temporally staggering the introduction of the experimental phases across the paired groups. In contrast to experiment 1, experiment 2 included an ABA reversal design which was used to investigate the supplemental effects of performance feedback for one group in each of the incentive pay systems (linear, positive and negative acceleration).

**RESULTS**

Mean widget production for the 6 groups and typical subjects is graphically displayed in Figures 7 through 12. The absolute change in productivity mean and the cost-per-widget are summarized in Table 3 and a summary of the percent of change in the mean and cost-per-widget is presented in Table 4.

**Number of Widgets Produced**

*Linear Groups.* The data for the two groups which changed from the flat pay condition to the linear incentive pay condition are presented in Figure 7. An increase in widget productivity occurred for both groups after the introduction of the linear pay system with feedback. For group 1, mean productivity increased from 22.3 during the baseline phase to 26.3 in the incentive with feedback phase for a 17.9% increase over the flat pay condition. An additional improvement in productivity occurred when the feedback variable was removed. Mean widget productivity increased by an additional 12.2% going from 26.3 to 29.5. For group 2, mean productivity increased from 13.8 to 19.3 representing a 39.9% increase over the flat pay condition. With respect to performance variability, the data show a conflicting pattern in that during the flat pay condition performance was more variable for subjects in group 1. However, during the incentive with feedback phase, there was greater variability among subjects in group 2. There was no variability for group 1 during the reversal phase.

The data for typical subjects are presented in Figure 8. Of the subjects in group 1, the performance of subject 1 was most representative in terms of overall trends and variability, however, the data do not trace exactly the
FIGURE 7. The mean number of widgets produced per session by groups in Experiment 2 who were exposed to the Linear incentive pay system with and without feedback.
FIGURE 8. The mean number of widgets produced per session by typical subjects in groups 1 and 2 in Experiment 2 who were exposed to the Linear incentive pay system with and without feedback.
FIGURE 9. The mean number of widgets produced per session by groups in Experiment 2 who were exposed to the Positively Accelerating incentive pay system with and without feedback.
FIGURE 10. The mean number of widgets produced per session by typical subjects in groups 3 and 4 in Experiment 2 who were exposed to the Positively Accelerating incentive pay system with and without feedback.
FIGURE 11. The mean number of widgets produced per session by groups in Experiment 2 who were exposed to the Negatively Accelerating pay system with and without feedback.
FIGURE 12. The mean number of widgets produced per session by typical subjects in groups 5 and 6 in Experiment 2 who were exposed to the Negatively Accelerating incentive pay system with and without feedback.
TABLE 3. Absolute Change in Mean Widget Productivity and Cost per Widget in Experiment 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>Flat Pay Condition</th>
<th>Incentive Pay With Feedback Condition</th>
<th>Incentive Pay Without Feedback Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear #1</td>
<td>M = 22.3 CPW = .07</td>
<td>M = 26.3 CPW = .10</td>
<td>M = 29.5 CPW = .10</td>
</tr>
<tr>
<td>Linear #2</td>
<td>M = 13.8 CPW = .11</td>
<td>M = 19.3 CPW = .10</td>
<td>M = 29.5 CPW = .09</td>
</tr>
<tr>
<td>Positively Accelerating #3</td>
<td>M = 25.0 CPW = .06</td>
<td>M = 27.1 CPW = .09</td>
<td>M = 29.5 CPW = .09</td>
</tr>
<tr>
<td>Positively Accelerating #4</td>
<td>M = 22.6 CPW = .10</td>
<td>M = 27.2 CPW = .11</td>
<td></td>
</tr>
<tr>
<td>Negatively Accelerating #5</td>
<td>M = 14.8 CPW = .10</td>
<td>M = 20.0 CPW = .08</td>
<td>M = 20.7 CPW = .07</td>
</tr>
<tr>
<td>Negatively Accelerating #6</td>
<td>M = 20.2 CPW = .07</td>
<td>M = 23.6 CPW = .07</td>
<td></td>
</tr>
</tbody>
</table>

CPW = Cost per Widget

pattern of the group data. The mean widget productivity during the linear without feedback phase improved to 32.3 representing a 40% increase over the flat pay condition compared to an increase of 33.3% for the group. Subject 2 was most characteristic of the productivity and variability patterns observed in the group data.

Positively Accelerating Groups. Figure 9 illustrates the data for the two groups that changed from the flat pay condition to the positively accelerating pay condition. For group 3, widget productivity increased from a mean of 25.0 during the flat pay condition to 27.1 during the positive acceleration with feedback condition representing a slight increase of 8.4%. After feedback was eliminated, productivity increased by another 8.9%. A more dramatic increase in productivity was observed in group 4 after the introduction of the positive acceleration system with feedback. Mean widget productivity increased from 22.6 during baseline to 27.2 during the incentive condition for a 20.4% increase over the flat pay condition. With respect to performance variability, the data indicate considerably greater variability across work sessions during the flat pay condition for group 4 than for group 3 and similar patterns during the incentive with feedback condition. Productivity was fairly stable for group 3 during all experimen-
## TABLE 4. Percent Change in Mean Widget Productivity and Cost per Widget in Experiment 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>Percent Productivity Change in Incentive w/ Feedback Condition</th>
<th>Percent Cost per Widget Change in Incentive w/ Feedback Condition</th>
<th>Percent Productivity Change in Incentive w/o Feedback Condition</th>
<th>Percent Cost per Widget Change in Incentive w/o Feedback Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear # 1</td>
<td>17.9%</td>
<td>42.9%</td>
<td>12.2%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Linear # 2</td>
<td>39.9%</td>
<td>9.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positively Accelerating # 3</td>
<td>8.4%</td>
<td>50.0%</td>
<td>8.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Positively Accelerating # 4</td>
<td>20.4%</td>
<td>10.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negatively Accelerating # 5</td>
<td>35.1%</td>
<td>-20.0%</td>
<td>3.5%</td>
<td>-10.0%</td>
</tr>
<tr>
<td>Negatively Accelerating # 6</td>
<td>16.8%</td>
<td>0.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
tal phases, whereas productivity stabilized for group 4 after the introduction of the incentive with feedback condition.

Figure 10 presents the data for typical subjects in groups 3 and 4, respectively. The performance trends and variability pattern for subject 3 closely approximates the group 3 data. The performance of subject 4 is most representative of group 4 in that mean productivity closely traces the group mean in both conditions; however, the group data show slightly more variability during the flat pay condition.

**Negatively Accelerating Groups.** The data for the two groups that were paid under the negatively accelerating pay system are displayed in Figure 11. Productivity for group 5 increased by 35.1% after the incentive with feedback condition was introduced. An additional increase in mean widget production (3.5%) occurred once the feedback was removed. Productivity improved under the negatively accelerating pay with feedback condition for group 6, but the increase was not as great. The mean increased from 20.2 to 23.6 for an increase of 16.8% over the flat pay condition. As for performance variability, there was a remarkable difference between the two groups during the flat pay condition. Performance was relatively stable for group 5, whereas productivity fluctuated significantly between work sessions for group 6. Variability during the incentive with feedback condition was comparable and little variability was observed in the incentive without feedback condition.

The performance data for typical subjects are presented in Figure 12. Typical features of the group data are the performance trends, productivity levels, and variability data of subject 5 in group 5 and subject 6 in group 6 were most representative of the group data.

**Cost per Widget**

**Linear Groups.** During the baseline, flat pay condition the cost per widget was .07 and .11 for groups 1 and 2, respectively. Because the essential aspect of a linear system is that each widget be worth the same amount, the cost per widget during the incentive condition was constant at .10. A comparison of the data for the two pay conditions reveals contrasting results for the two groups. For group 1, there was a 42.9% increase in cost per widget when working under the incentive pay condition (with and without feedback). For group 2, there was a 9.1% decrease in cost per widget during the incentive pay condition.

**Positively Accelerating Groups.** For group 3, the mean cost per widget during the flat pay condition of .06 increased to .09 during incentive with feedback condition. The cost remained at .09 during the incentive without feedback condition for group 3. These changes represent a 50% increase in
cost. For group 4, the mean cost per widget during the flat pay condition was .10 and increased to .11 during the incentive with feedback condition resulting in a 10% increase.

**Negative Accelerating Groups.** For groups 5 and 6, the mean cost per widget was .10 and .07, respectively, when subjects worked under the flat pay condition. After the incentive with feedback condition was introduced, the mean cost per widget decreased to .08 for group 5 and a further reduction in cost, to .07, occurred after the feedback condition was eliminated. Therefore, the cumulative decrease in cost per widget under the incentive pay system for group 5 was 30%. Because the cost per widget remained at .07 in both conditions, there was no change in cost for group 6.

**DISCUSSION**

It is apparent from the data that the three incentive pay systems in combination with performance feedback generated higher levels of productivity than did the flat pay system. As was observed in experiment 1, the three incentive pay systems yielded differential effects on widget productivity and cost per widget. With respect to widget productivity, the data indicate the linear pay condition with/without feedback exerted the greatest power over performance. For the linear groups, the overall mean increase of 36.1% was greater than the overall mean of 28.4% for the negatively accelerating groups and the overall mean increase of 19.2% for the positively accelerating groups. With respect to cost per widget, the negatively accelerating pay system seems to be the most beneficial in that a 30% decrease in cost was observed in one group and no increase in cost over the flat condition was observed in the other group. In comparison, there was an average increase in cost of 39.3% under the positively accelerating system and an average increase in cost of 16.9% under the linear pay system. The significance of these findings should be tempered in that the flat pay per session in this study was $1.50 as compared to $2.00 in experiment 1. The fact remains, however, that the incentive pay systems consistently controlled higher rates of productivity regardless of the level of flat pay.

Taken together, the productivity and cost data offer some options for the designer of pay systems. The negatively accelerating pay system appears to present the most reasonable option. One group increased performance by 16.8% and produced no additional increase in cost, while the other group increased performance by 39.9% and decreased cost by 30%. While the linear system offers a clear benefit in terms of productivity, moderate
cost increases appear to offset a significant portion of the benefit derived from greater productivity. Based on the data, the positively accelerating system is the least attractive yielding substantial increases in cost and only moderate increases in productivity.

With respect to the supplemental effects of immediate feedback, the data suggest that feedback did not provide any supplemental power to the incentive pay systems. What was actually observed was that immediate feedback had a negative effect on productivity. When subjects were no longer required to use the check-off sheets, widget productivity in all three groups improved. However, there are other plausible explanations for the observed effects which make definitive conclusions about the supplemental effects of feedback, at least for this study, tenable. First, the physical checking-off activity may have reduced production time sufficiently to result in subjects producing fewer widgets than possible. Therefore, when the physical interruptions to widget production were eliminated, with the removal of the feedback manipulation, productivity improved. This seems a reasonable conclusion given that productivity in the groups without the feedback reversal did not increase simultaneously with the increase in productivity after feedback was removed for the other groups. Second, the effects of official feedback in the incentive with feedback condition may have carried over, as self-administered/unofficial feedback, to the incentive without feedback condition. During the incentive with feedback condition, subjects were repeatedly exposed, for 15 minute periods, to the contents of the incentive systems. This repeated exposure to the textual stimuli may have resulted in subjects memorizing the pay scales and then, later, recalling the amounts earned while engaging in the widget making task. Given that the textual stimuli were consistently paired with the widget making environment, it is very likely that the contextual stimuli of the widget making environment would evoke recall of the pay scale in the absence of the textual stimuli. Therefore, the increased productivity during the incentive without feedback condition may not have occurred simply because the physical feedback activity was removed. The effect may have been a function of a combination of unofficial supplemental feedback and the elimination of the physical checking-off activity.

**EXPERIMENT 3**

In experiment 3 the flat and incentive pay systems employed in experiment 2 were retained but the feedback manipulation was eliminated. Experiment 3 is distinguished from the prior two experiments in two ways: the number of work sessions was extended from 20 to 25; and a group vs.
individual work setting manipulation was added. The work setting variable was added because it is important to investigate the efficacy of incentive pay systems on worker performance under various environmental conditions. Typically, individuals do not work in complete isolation from others. Rather, even when working individually (vs. being part of an official work group/team), individuals typically work in the presence of other workers in the organization. Therefore, looking at the power of incentive pay systems in the presence and absence of others may tell us more about the characteristics of the optimal incentive pay system.

**METHOD**

**Subjects**

Subjects were 30 college students who were randomly assigned to 6 experimental groups containing 5 subjects each. Two subjects, one from each of the linear groups, failed to complete the study. Therefore, the data for each of the linear groups is based on the performance of 4 subjects.

**Work Task**

The work task was identical to the widget-making task employed in experiment 1.

**Independent Variable**

The pay system by which subjects were paid for each work session and the work setting (group or individual) served as the independent variables.

**Experimental Design**

A within-subjects, multiple-baseline design with counterbalancing was employed. The within-subjects and multiple-baseline manipulations were identical to the design of experiments 1 and 2. The counterbalance element of the design was achieved by reversing the order of the introduction of the group and individual work setting for the two paired groups. For example, linear group 1 began working in the group work setting while linear group 2 began working in the individual work setting. The purpose of the counterbalancing manipulation was to discount sequence effects as a confounding variable.
RESULTS

Group and individual productivity data are presented in Figures 13 through 23. Tables 5 and 6 include a summary of the absolute and relative changes in widget productivity and cost per widget.

**Number of Widgets Produced**

*Linear Groups.* Figure 13 displays the data for the two linear groups. Widget productivity increased substantially in both groups after the introduction of the incentive pay system. For group 1, which began working in the group work setting, the mean increased from 21.6 during the group flat pay condition to 25.8 in the group linear condition for a 19.4% improvement over flat pay. No change occurred after the introduction of the individual linear pay condition. With respect to group 2, which began working in the individual setting, the mean changed from 21.3 during baseline to 26.7 during the individual linear phase representing a 25.4% increase over the flat pay condition. Once the group linear condition was introduced, performance decreased by 9.7% going from a mean of 26.7 to 24.1. The overall change in productivity for group 2 equaled a net increase of 15.7%. In terms of variability, performance appeared to be more variable for both groups during the flat pay and linear group conditions. Because of a high rate of absenteeism among the subjects in group 1 (38 of 100 data points) and in group 2 (30 of 100 data points), typical performance could not be assessed with much accuracy. A large number of gaps in the data preclude drawing any conclusions regarding trends and variability.

*Positively Accelerating Groups.* The data for the two positively accelerating groups (3 and 4) appear in Figure 14. The data for both groups indicate increases in productivity occurred during the incentive pay condition regardless of the work setting. For instance, when the individual positively accelerating condition was introduced for group 3, widget production increased by 32.6% as the mean improved from 22.1, during the flat pay baseline phase, to 29.6. An additional increase of 6.1% was generated after the introduction of the group positively accelerating condition, resulting in an overall productivity increase of 42.1%. A similar pattern was observed in group 4, which began working in the group setting. After the group incentive condition was in place, the mean increased from 21.8 to 28.8 yielding an improvement of 32.1%. Productivity improved further after the introduction of the individual positively accelerating condition when the mean increased from 28.8 to 31.9 representing an overall increase of 46.3% over the flat pay condition. The performance trends gen-
FIGURE 13. The mean number of widgets produced per session by groups in Experiment 3 who were exposed to the Linear incentive pay system while in a group and individual work setting.
FIGURE 14. The mean number of widgets produced per session by groups in Experiment 3 who were exposed to the Positively Accelerating incentive pay system while in a group and individual work setting.
FIGURE 15. The mean number of widgets produced per session by typical subjects in groups 3 and 4 in Experiment 3 who were exposed to the Positively Accelerating incentive pay system while in a group and individual work setting.
FIGURE 16. The mean number of widgets produced per session by groups in Experiment 3 who were exposed to the Negatively Accelerating incentive pay system while in a group and individual work setting.
FIGURE 17. The mean number of widgets produced per session by typical subjects in groups 5 and 6 in Experiment 3 who were exposed to the Negatively Accelerating incentive pay system while in a group and individual work setting.
FIGURE 18. The mean number of widgets produced per session by groups in Experiment 4 who were exposed to the Linear incentive pay system while in a group and individual work setting.
FIGURE 19. The mean number of widgets produced per session by typical subjects in groups 1 and 2 in Experiment 4 who were exposed to the Linear incentive pay system while in a group and individual work setting.
FIGURE 20. The mean number of widgets produced per session by groups in Experiment 4 who were exposed to the Positively Accelerating incentive pay system while in a group and individual work setting.
FIGURE 21. The mean number of widgets produced per session by typical subject in groups 3 and 4 in Experiment 4 who were exposed to the Positively Accelerating incentive pay system while in a group and individual work setting.
FIGURE 22. The mean number of widgets produced per session by groups in Experiment 4 who were exposed to the Negatively Accelerating incentive pay system while in a group and individual work setting.
FIGURE 23. The mean number of widgets produced per session by a typical subject in group 5 in Experiment 4 who was exposed to the Negatively Accelerating incentive pay system while in a group and individual work setting.

Generally support the analysis of the productivity data, but there is one interesting point with respect to group 3. While mean productivity increased during the group incentive condition, six of the eight data points are below the last two data points in the previous experimental phase (individual positively accelerating). With respect to variability, performance was quite variable for both groups during the flat pay condition. For both groups, variability was greater during the first incentive condition than during the second incentive condition. Figure 15 illustrates the data of typical subjects (1 and 2). The performance of subject 1 was more typical than other subjects in group 3; however, the data do not trace the group data exactly. Mean productivity during the flat individual condition and the group positively accelerating, overall variability, and the immediate decline in productivity during the group incentive condition track the group data. The data deviate with respect to mean productivity during the individual incentive condition and productivity immediately declined after the introduction of the individual positively accelerating pay condition. Subject 2 was most characteristic of group 4 in terms of performance trends after the
### TABLE 5. Absolute Change in Mean Widget Productivity and Cost per Widget in Experiment 3.

<table>
<thead>
<tr>
<th>Group</th>
<th>Flat Pay Condition</th>
<th>Incentive Pay in Group</th>
<th>Incentive Pay in Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M = 21.6</td>
<td>M = 25.8</td>
<td>M = 25.8</td>
</tr>
<tr>
<td></td>
<td>CPW = .07</td>
<td>CPW = .10</td>
<td>CPW = .10</td>
</tr>
<tr>
<td>Linear #1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M = 21.3</td>
<td>M = 24.1</td>
<td>M = 26.7</td>
</tr>
<tr>
<td></td>
<td>CPW = .07</td>
<td>CPW = .10</td>
<td>CPW = .10</td>
</tr>
<tr>
<td>Linear #2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positively Accelerating #3</td>
<td>M = 22.1</td>
<td>M = 31.4</td>
<td>M = 29.6</td>
</tr>
<tr>
<td></td>
<td>CPW = .06</td>
<td>CPW = .13</td>
<td>CPW = .14</td>
</tr>
<tr>
<td>Positively Accelerating #4</td>
<td>M = 21.8</td>
<td>M = 28.8</td>
<td>M = 31.9</td>
</tr>
<tr>
<td></td>
<td>CPW = .07</td>
<td>CPW = .12</td>
<td>CPW = .12</td>
</tr>
<tr>
<td>Negatively Accelerating #5</td>
<td>M = 18.7</td>
<td>M = 26.1</td>
<td>M = 27.0</td>
</tr>
<tr>
<td></td>
<td>CPW = .08</td>
<td>CPW = .09</td>
<td>CPW = .08</td>
</tr>
<tr>
<td>Negatively Accelerating #6</td>
<td>M = 24.1</td>
<td>M = 29.5</td>
<td>M = 28.5</td>
</tr>
<tr>
<td></td>
<td>CPW = .06</td>
<td>CPW = .08</td>
<td>CPW = .08</td>
</tr>
</tbody>
</table>

CPW = Cost per Widget

Introduction of the incentive pay conditions and overall variability. However, mean productivity was higher than the group's productivity in all conditions.

Negatively Accelerating Groups. The data for the negatively accelerating groups (5 and 6) appear in Figure 16. What was observed in the linear and positively accelerating groups was also seen with the negatively accelerating groups. Widget productivity increased after the introduction of the incentive pay system. For group 5, productivity increased from a mean of 18.7 to 26.1 representing an improvement of 39.6% over the flat pay condition. An additional increase of 3.5% was observed after the introduction of the individual incentive condition. An overall gain in productivity of 44.4% was generated by the incentive pay system. A more moderate increase was observed in group 6 where mean productivity increased from 24.1 to 28.5 which translates to an increase of 17.8% over flat pay. Mean productivity increased by an additional 3.5% during the group negatively accelerating condition. The overall gain for group 6 was 22.4%. With respect to performance patterns, widget productivity remained variable for both groups across all pay conditions. However, for group 6, the last 2 data points in the individual incentive condition and the first 2 data points in the group incentive condition show some pattern of stabilization.
<table>
<thead>
<tr>
<th>Group</th>
<th>Percent Productivity Change in Incentive Group Work Setting</th>
<th>Percent Cost per Widget Change in Incentive Group Work Setting</th>
<th>Percent Productivity Change in Incentive Ind. Work Setting</th>
<th>Percent Cost per Widget Change in Incentive Ind. Work Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear # 1</td>
<td>19.4%</td>
<td>42.9%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Linear # 2</td>
<td>9.7%</td>
<td>0.0%</td>
<td>25.4%</td>
<td>42.9%</td>
</tr>
<tr>
<td>Positively Accelerating # 3</td>
<td>6.1%</td>
<td>7.6%</td>
<td>32.6%</td>
<td>85.7%</td>
</tr>
<tr>
<td>Positively Accelerating # 4</td>
<td>32.1%</td>
<td>71.4%</td>
<td>10.8%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Negatively Accelerating # 5</td>
<td>39.6%</td>
<td>1.25%</td>
<td>3.5%</td>
<td>-12.5%</td>
</tr>
<tr>
<td>Negatively Accelerating # 6</td>
<td>3.5%</td>
<td>0.0%</td>
<td>17.8%</td>
<td>33.3%</td>
</tr>
</tbody>
</table>
Figure 17 displays the data for typical subjects (3 and 4) for groups 5 and 6, respectively. The performance of subject 3 is most representative of group 5 with respect to mean productivity, performance trends after the introduction of the incentive conditions, and overall variability. Most representative of group 4 is the performance of subject 6 in that mean productivity and variability are similar for the flat and individual incentive condition.

**Cost per Widget**

*Linear Groups.* The mean cost per widget during the baseline and experimental conditions was the same for group 1 and 2. During the baseline flat pay condition the cost per widget was .07 which increased to .10 (by virtue of the design of the linear pay scale) during the linear incentive conditions representing a 42.9% increase in cost.

*Positively Accelerating Groups.* For group 3, the mean cost per widget, during the flat pay individual condition, was .07. Cost increased to .13 (+ 85.7%) during the individual incentive condition with an additional 7.6% increase, to .14, occurring during the group incentive condition. The overall increase in cost per widget was 100%. The cost per widget also increased substantially for group 4, beginning at .07 during the group flat pay condition and increasing to .12 during the group incentive condition. No further change in cost was observed in the individual incentive condition. The increase from .07 to .12 represents a 71.4% increase in cost per widget.

*Negatively Accelerating Groups.* For group 5, mean widget cost increased from .08 during the group flat condition to .09 during the group incentive condition. However, the cost per widget returned to .08 during the individual negatively accelerating condition resulting in no change in cost overall. For group 6, cost increased from .06 during the individual flat pay condition to .08 after the introduction of the individual negatively accelerating condition representing a 33.3% increase. There was no further change in cost per widget during the group incentive condition.

**DISCUSSION**

The results from experiment 3 clearly indicate that the three incentive pay systems controlled higher levels of productivity than the flat pay system. Particularly convincing evidence for this assertion is the fact that the incentive systems, without exception, generated higher rates of widget
Experiment

production during the individual and group work settings. Therefore, the efficacy of the incentive pay systems was demonstrated irrespective of whether subjects worked alone or in the presence of other subjects. However, the incentive pay systems, in combination with the work setting manipulation, differentially affected widget productivity and cost per widget. Interestingly, the widget productivity results of experiment 3 are in contrast to the productivity results of the prior two experiments. For experiments 1 and 2, the linear incentive system was most effective with respect to productivity, whereas in this experiment the positively accelerating incentive system was the most effective. The overall increase in mean widget productivity for the two positive accelerating groups was 44.2%, which was considerably higher than the mean increase of 33.4% for the negatively accelerating groups and 17.6% for the linear groups. With respect to cost per widget, the evaluation of the incentive systems is consistent with the findings in experiment 1 and 2. The negatively accelerating system was the most cost effective in that no increase in cost was observed in one group and an increase of 33.3% occurred for the other group in comparison with the mean cost increase of 85.7% for the positively accelerating system and a mean increase of 42.9% for the linear groups.

When considering the productivity and cost data together, the negatively accelerating incentive system emerges as the most attractive option. The negatively accelerating system generated substantial increases in widget productivity in both groups with no increase in cost in one group and a 33.3% cost increase in the other group. While the positively accelerating pay system produced significant increases in productivity, the mean cost increase of 85.7% offsets any benefits derived from productivity increases. The linear system appears to be the least attractive option in that only moderate increases in productivity were generated at a substantial increase in cost.

While the manipulation of the pay system produced clear differences, the precise impact that the presence or absence of others has upon the incentive pay systems remains somewhat unclear. First, the data indicate that any change in work setting, individual to group or group to individual, has some effect on productivity under all of the incentive systems. This effect was observed in 5 of the 6 groups with increases in productivity observed in 4 groups and lowered productivity observed in 1 group. Second, while the data discount any sequence effect in terms of the pattern of the introduction of the individual and group work setting, there appears to have been some sort of sequence variable present. For the positively and negatively accelerating groups, productivity increased during the final
experimental condition irrespective of the work setting. For example, when subjects in group 3 were changed from the individual positively accelerating incentive condition to the group incentive condition, productivity increased; when subjects in group 4 were changed from the group positively accelerating incentive condition to the individual group condition, productivity increased. Third, the largest increase in widget productivity always occurred during the first incentive pay condition irrespective of the work setting. For example, when looking at the positively accelerating groups (3 and 4), productivity for group 3 increased by 32.6% during the first positively accelerating condition (individual work setting) and a small additional increase of 6.1% occurred during the second incentive condition (group work setting). As for group 4, productivity increased by 32.1% during the first incentive condition (group work setting) and an additional increase of 10.8% was observed during the second incentive condition (individual work setting). One plausible explanation for these observations is that there was a ceiling effect during the final experimental condition which restricted the range of productivity increases much beyond those observed in the first incentive condition.

Though the present data are indicative of the power of the incentive pay systems over performance improvements, control problems encountered during the conducting of the study call for some caution in drawing definitive conclusions. This is especially the case with the linear incentive system. First, investigator bias was very likely introduced into the study by two research assistants who socialized with their subjects (linear group 1 and negatively accelerating group 1) and, therefore, failed to follow standard research practices with respect to unbiased treatment of subjects. Second, this socialization resulted in subjects in the two referenced groups receiving feedback on their performance relative to the performance of subjects in other groups. Third, excessive absenteeism for the two linear groups resulted in significantly less data points than the other groups. For three work sessions, the reported mean productivity and cost per widget is based upon the performance of 1 subject.

**EXPERIMENT 4**

Because of the control problems, specifically investigator bias and socially-mediated feedback, in experiment 3, which make some of the reported results questionable, experiment 4 replicated the research questions posed in experiment 3 with respect to the efficacy of the incentive pay system, and the effect of group and individual work settings on performance when subjects are paid under the three incentive pay systems.
Therefore, the flat and incentive pay systems and the work setting manipulation were retained in experiment 4. The control problems were solved by training new research assistants and closely supervising the assistants throughout the study to assure intervention integrity.

Experiment 4 can also be considered an extension of the prior study because of the addition of other data sets and minor design changes. The new data sets included calculation of percentage of incentive to base pay, explicit tracking of the frequency of absenteeism, and quality of work. Also, anecdotal data was collected on the type and frequency of off-task behaviors and a debriefing session was held to gather self-report data as a manipulation check and to gather information on how subjects used the money they earned during the study. Learning what subjects do with their earnings is useful information in incentive research because one of the criticisms, and suggested limitations of research which pays small amounts, is that the money is discretionary and, therefore, unlike money earned in "real" jobs.

**METHOD**

**Subjects**

Subjects were 24 college students who were randomly assigned to 6 experimental groups of 4 subjects each. Four subjects failed to complete the study: one each from a linear group (group 2) and a negatively accelerating group (group 5); two from the other negatively accelerating group (group 6). Therefore, the data are based on the productivity of 20 subjects.

**Work Task**

The work task was identical to the widget-making task employed in experiment 1.

**Dependent Variable**

The primary dependent variable was the number of widgets produced per work session within each pay and work setting condition. The cost per widget in each work setting and experimental condition was the secondary dependent variable. Additional measures included percent of incentive to base pay, tracking of the number of incorrect widgets produced per work
session and experimental condition, and tracking of the number of work session absences for each experimental condition.

RESULTS

Figures 18 through 23 display the group and individual productivity data. Tables 7 and 8 summarize absolute and relative changes in widget productivity and cost per widget.

Number of Widgets Produced

Linear Groups. The productivity data for linear groups 1 and 2 are presented in Figure 18. A substantial increase in mean productivity occurred after the introduction of the incentive condition. The mean increased from 17.3 during the flat pay condition to 22.3 during the individual linear condition for a 29% increase over flat pay. When subjects were changed to the group linear condition, productivity decreased from a mean of 22.3 to 21.0 resulting in a 6% reduction. Performance was slightly more variable during the incentive conditions. For group 2, which began work-

<table>
<thead>
<tr>
<th>Group</th>
<th>Flat Pay Condition</th>
<th>Incentive Pay in Group Setting</th>
<th>Incentive Pay in Individual Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear #1</td>
<td>M = 17.3</td>
<td>M = 21.0</td>
<td>M = 22.3</td>
</tr>
<tr>
<td></td>
<td>CPW = .08</td>
<td>CPW = .10</td>
<td>CPW = .10</td>
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<tr>
<td>Linear #2</td>
<td>M = 27.9</td>
<td>M = 33.2</td>
<td>M = 32.0</td>
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<tr>
<td></td>
<td>CPW = .05</td>
<td>CPW = .10</td>
<td>CPW = .10</td>
</tr>
<tr>
<td>Positively Accelerating #3</td>
<td>M = 22.4</td>
<td>M = 32.3</td>
<td>M = 32.0</td>
</tr>
<tr>
<td></td>
<td>CPW = .07</td>
<td>CPW = .13</td>
<td>CPW = .13</td>
</tr>
<tr>
<td>Positively Accelerating #4</td>
<td>M = 20.1</td>
<td>M = 26.4</td>
<td>M = 28.2</td>
</tr>
<tr>
<td></td>
<td>CPW = .08</td>
<td>CPW = .12</td>
<td>CPW = .12</td>
</tr>
<tr>
<td>Negatively Accelerating #5</td>
<td>M = 14.6</td>
<td>M = 20.2</td>
<td>M = 22.4</td>
</tr>
<tr>
<td></td>
<td>CPW = .11</td>
<td>CPW = .10</td>
<td>CPW = .09</td>
</tr>
<tr>
<td>Negatively Accelerating #6</td>
<td>M = 24.6</td>
<td>M = 30.5</td>
<td>M = 27.6</td>
</tr>
<tr>
<td></td>
<td>CPW = .06</td>
<td>CPW = .08</td>
<td>CPW = .08</td>
</tr>
</tbody>
</table>

CPW = Cost per Widget
TABLE 8. Percent Change in Mean Widget Productivity and Cost per Widget in Experiment 4.

<table>
<thead>
<tr>
<th>Group</th>
<th>Percent Productivity Change in Incentive Group Work Setting</th>
<th>Percent Cost per Widget Change in Incentive Group Work Setting</th>
<th>Percent Productivity Change in Incentive Ind. Work Setting</th>
<th>Percent Cost per Widget Change in Incentive Ind. Work Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear #1</td>
<td>-6.0%</td>
<td>0.0%</td>
<td>29.0%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Linear #2</td>
<td>19.0%</td>
<td>100.0%</td>
<td>-4.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Positively Accelerating #3</td>
<td>1.0%</td>
<td>0.0%</td>
<td>43.0%</td>
<td>86.0%</td>
</tr>
<tr>
<td>Positively Accelerating #4</td>
<td>31.0%</td>
<td>50.0%</td>
<td>7.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Negatively Accelerating #5</td>
<td>38.0%</td>
<td>-9.0%</td>
<td>11.0%</td>
<td>-10.0%</td>
</tr>
<tr>
<td>Negatively Accelerating #6</td>
<td>11.0%</td>
<td>0.0%</td>
<td>12.0%</td>
<td>33.0%</td>
</tr>
</tbody>
</table>
ing in the group work setting, the mean increased from 27.9 to 33.2 during the group linear condition which represented a 19% increase over flat pay. A 4% decrease occurred during the individual incentive condition where average productivity declined from 33.2 to 32.0. Performance was more consistent during the group linear condition than during the flat and individual incentive condition.

The data for typical subjects are presented in Figure 19. Subject 1 was most representative of the productivity trends and levels observed in linear group 1 in that the mean increased after the initial introduction of the linear pay system and a slight decrease occurred after the work setting change. However, performance was more variable than that for the group. Greater variability may be accounted for by the fact that subject 1 arrived late to six sessions (2 in flat pay, 1 in the individual incentive condition, and 3 during the group incentive condition), which resulted in a reduction in the number of widgets that could be produced during the session. The patterns observed in subject 2 were typical of the productivity trends in group 2. Widget productivity increased after the introduction of the group linear condition and declined slightly during the individual linear condition, and the pattern of variability is similar to the group trends. However, subject 2 does not perfectly trace the group data because subject 2 performed at higher rates in all the experimental conditions.

Positively Accelerating. Substantial productivity increases were observed in positively accelerating groups 3 and 4 (see Figure 20). Mean productivity for group 3 increased by 43% from 22.4 during the flat pay condition to 32.0 during the individual incentive condition. An additional 1% improvement, from 32.0 to 32.3, occurred after the introduction of the group positively accelerating condition. Productivity was somewhat more consistent during the group condition than during the flat pay and individual incentive condition. For group 4, productivity increased from a mean of 20.1 to 26.4 during the individual positively accelerating representing a 31% increase over flat pay. After group 4 changed to an individual work setting, productivity increased to a mean of 28.2 for an additional 7% productivity improvement. Variability observed during the flat pay condition decreased after the introduction of the group incentive condition. Performance became even more consistent during the individual positively accelerating condition.

Figure 21 displays the data for typical subjects. The performance of subject 3 was typical of the overall group data for group 3. Absolute changes in widget production and mean productivity were similar across the three experimental conditions. The subject’s performance during the flat pay condition was more stable than that of the group, but similar
patterns in variability were observed during the intervention phases. The performance of subject 4 closely approximates the performance patterns of group 4 in that immediate increases after the introduction of the incentive systems and mean levels within the incentive conditions were similar to the group's overall productivity levels.

Negatively Accelerating. As can be seen in Figure 22, higher levels of widget productivity occurred in group 5 and 6 during the incentive pay conditions. A substantial increase in mean was observed after group 5 changed to the group negatively accelerating pay condition. Widget production improved from a mean of 14.6, during the flat pay condition, to 20.2 representing a 38% increase. An additional increase of 11% occurred under the individual incentive condition. Productivity was more variable during the incentive conditions than during the flat pay condition. The data for negatively accelerating group 6 indicate a moderate increase of 12% after the introduction of the individual incentive condition where mean productivity went from 24.6 to 27.6. Once again, productivity increased when group 6 was changed to the group work setting. Under the group negatively accelerating condition performance improved by an additional 11%, from a mean of 27.6 to 30.5. With respect to variability, performance during the individual incentive condition became more consistent and variability increased under the group incentive condition.

The data for a typical subject in group 5 are presented in Figure 23. Because two subjects failed to complete the study, the data for group 6 represent the productivity of two subjects. Therefore, a discussion comparing typical and atypical performance data does not seem useful. With respect to group 5, productivity patterns for subject 5 were most representative of the group data. One deviation from the group data occurred during session 15 in the group incentive condition where subject 5's mean productivity dropped below the group's mean productivity level during the flat pay condition. This deviation is likely accounted for by the fact that the subject arrived late to the 15th work session which decreased the potential number of widgets that could be produced during that session. Also, the immediate change after the introduction of the incentive system was much greater for subject 5 than for the group (38% group vs. 69% subject 9).

Cost per Widget

Linear Groups. While paid under the flat pay condition, the mean cost per widget was .08 and .05 for group 1 and 2, respectively. Because of the system design, the cost per widget during the incentive pay conditions was
The increases under the linear pay system represent a 25% cost increase for group 1 and a 100% increase for group 2.

**Positively Accelerating.** A cost increase of 86% was observed in group 3 when cost increased from .07, during the flat pay condition, to .13 during the individual incentive condition. No change in cost was observed after the introduction of the group incentive condition. When group 4 changed from flat pay to the group incentive condition, cost increased from .08 to .12 representing a 50% increase in cost per widget. No change occurred during the individual incentive condition.

**Negatively Accelerating.** For group 5, the cost per widget was .11 during the flat pay condition and decreased to .10 during the group incentive condition resulting in a 9% decrease. After the individual incentive condition was introduced, cost decreased to .09 for an additional 10% cost reduction under the incentive system. In contrast, the data for group 6 indicate a cost increase of 33% during the individual incentive condition when mean cost went from .06 to .08. No change in cost was observed during the group incentive condition.

### Percent of Incentive to Base Pay

The percent of incentive to base pay was calculated using group mean data per work session and is presented as a range from the lowest to highest percent of incentive to base pay within each incentive pay condition. Because the number of work sessions per condition was not constant across all groups, the total amount of incentive pay was not used. The amount of base pay for all incentive conditions was the amount of money earned for producing 10 widgets because the base productivity requirement for all work sessions was 10 widgets. Therefore, the base pay for the linear condition was $1.00, for the positively accelerating condition was .55, and for the negatively accelerating condition was $1.43. The ranges of percent of incentive to base pay are as follows: (1) Linear group 1, 65.5% to 73.0% during the group work setting and 60.0% to 72.2% during the individual work setting; (2) Linear group 2, 33.3% to 67.7% during the individual work setting and 23.1% to 63.0% during the group work setting; (3) Positively accelerating group 3, 79.2% to 89.4% during the individual work setting and 82.5% to 89.0% during the group work setting; (4) Positively accelerating group 4, 72.5% to 88.7% during the group work setting and 72.5% to 89.0% during the individual work setting; (5) Negatively accelerating group 5, 0.0% to 36.7% during the group work setting and 0.0% to 42.8% during the individual work setting;
and (6) Negatively accelerating group 6, 35.9% to 38.6% during the individual work setting and 35.4% to 42.6% during the group work setting.

**Quality of Widgets Produced**

The quality of widgets was protected by the experimental design in that subjects were paid only for correctly made widgets. Therefore, making incorrect widgets reduced the number of correct widgets that could be produced during a session, thereby reducing the amount of incentive pay that could be earned. Eleven thousand three hundred correct and 47 incorrect widgets (30 during the flat pay condition and 17 during the incentive conditions) were produced. One plausible explanation for the greater number of errors during the flat pay condition is found in the learning curve. While the production task was relatively simple, the task was not one that subjects would typically engage in. Therefore, subjects may have needed a learning period to become proficient at widget construction. This explanation is supported in that none of the errors during the flat pay condition occurred after the seventh work session. Another reasonable explanation concerns the use of pop beads to construct widgets. The small size of the beads may have limited proficiency, particularly for males who were observed to have greater difficulty in picking up and holding on to the beads. A third limiting factor on proficiency may have been stress arising from the pressure of working under timed conditions.

The greater number of errors occurred during the positively accelerating incentive conditions where the highest levels of productivity were observed. The least number of errors occurred during the negatively accelerating incentive conditions where the lowest levels of productivity were observed. These data indicate that as quantity increases substantially, quality decreases. Previous research attempts to control quality while increasing quantity have shown this inverse relationship. However, in the present study no errors occurred during the incentive conditions for four of the six groups, yet increases in productivity were observed in these four groups.

**Worker Absenteeism**

While worker absenteeism was not an explicitly manipulated variable in experiment 4, consideration of absenteeism seems appropriate to defining the optimum individual monetary incentive pay system (Johnstone et al., 1989). Absenteeism for the linear groups more than doubled during the incentive pay conditions, going from an average of 6% to 16%. A very slight increase in absences was observed after the positively accelerating groups were changed from the flat to the incentive conditions, going from
6% to 6.5%. A similar change, 9.5% to 10%, occurred in the negatively accelerating groups. Total absences were highest during the individual incentive conditions. Only four subjects attended all 25 work sessions: 1 subject in linear group 1; 2 subjects each in positively accelerating groups 3 and 4; and 1 subject in the negatively accelerating group 5.

Off-Task Behaviors

The data for off-task behaviors was collected through casual observations by the research assistants and, therefore, should be viewed as tentative. However, it is interesting to note that off-task behaviors were observed only during the flat pay condition (being late to a work session was not included as an off-task behavior). Off-task behaviors were not observed during the incentive pay conditions. During 9 of the 10 work sessions in the flat pay condition, subject 2 in linear group 2 made the ten widget minimum and then studied. A similar situation occurred for subject 5 in the positively accelerating group 3. The subject was observed to make 22 widgets per session during 6 of 7 sessions and then read for the remainder of the work session. For the negatively accelerating group 5, subject 9 would make 11 or 12 widgets per session and then sleep for the remainder of the work session.

Debriefing Session

Self-reports indicated that the vast majority of the subjects viewed the work sessions very much as a real work situation. Factors which the subjects considered when making such reports were the fact that they had to come to work 25 separate days and they had to report to work at a specified time each day, the minimum work requirement in order to receive any pay for the work session, and the use of their earnings. Subjects reported using their earnings to open a savings account, to buy gasoline, food and clothing, to pay parking fines, and to do laundry. The subjects reported that these were necessary expenditures, not discretionary spending.

DISCUSSION

It seems clear that what has been seen in the prior three experiments was also observed in the present study—the three incentive pay systems controlled higher rates of productivity than did flat pay systems. Increases
in widget productivity occurred for all groups immediately after the introduction of the incentive pay system regardless of the work setting. And, productivity levels higher than the mean level during the flat pay condition were sustained throughout the incentive conditions with one exception (1 of 15 sessions) in the linear group 1. Therefore, it is reasonable to conclude that, in fact, the incentive pay systems controlled higher levels of behavior.

With respect to performance consistency, in 9 out of 12 experimental conditions, performance was less variable than that observed during the flat pay condition. The exceptions occurred for linear group 1 and positively accelerating group 3. For the linear group, variability increased during the individual incentive condition but returned to the flat pay condition level during the group incentive condition. A similar increase in variability occurred for the positively accelerating group when performance was less consistent during the individual incentive condition than during the flat pay condition.

As was observed in the previous experiments, productivity and cost per widget were differentially affected by the linear, positively and negatively accelerating incentive pay systems. The current data suggest that the positively accelerating pay system is best with respect to widget productivity. Over all incentive pay conditions (individual and group work setting), the mean increase of 41.0% for the positively accelerating system was larger than the mean increase for the negatively accelerating system (36.0%) and the mean increase for the linear system (19%).

When considering cost per widget, the data indicate the negatively accelerating system to be the most desirable. The 19.0% cost decrease in one group together with the 33.0% increase in the other group yielded an average cost per widget increase of 7.0% over the mean cost per widget during the flat pay condition. Both positively accelerating groups showed substantial increases in cost which translated to an overall mean cost per widget increase of 68.0%. As for the linear groups, the overall mean increase in cost per widget was 62.5% over the flat pay cost.

Productivity and cost data together indicate a differential overall affect of the three incentive systems. The negatively accelerating system appears to present the most practical option. The data show considerable increases in widget productivity while yielding a slight overall increase in cost. On the other hand, the positively accelerating system offers a clear benefit in terms of increased productivity which may be attractive given the right circumstances. Should a business or an industry need a large, fast increase in product output, the positively accelerating system may well be the system of choice. However, under stable conditions, the positively acceler-
ating system is far less attractive because the 68.0% cost increase seems to offset the 42.0% improvement in productivity. The linear system is the least attractive yielding a substantial increase in cost per widget and a moderate increase in productivity.

While the manipulation of the pay system produced clear differences in performance and cost, the precise impact that the presence or absence of co-workers has upon the incentive pay systems remains somewhat unclear. As was the case with experiment 3, the data in experiment 4 indicate that any change in work setting (individual to group; group to individual) has some effect on widget productivity level. Both linear groups produced a slight decrease of 6.0% to 4.0% with, of course, no change in cost during the second work setting. Slight productivity increases of 1.0% and 7.0% were observed in the positively accelerating groups with no change in cost per widget after the work setting was changed. The greatest increase in productivity after the work setting change occurred for the linear groups, regardless of the initial work setting. For groups 1 and 2, widget productivity improved by an additional 11.0% during the second work setting. In addition, cost per widget decreased by 10.0% for one group and remained stable for the other group.

With respect to percent of incentive to base pay, the current data appear to contradict Fein (1970) and Henderson (1985) in that incentive pay levels above 30.0% did result in productivity increases above the 30.0% incentive to base pay level. The 30.0% incentive to base pay level for the linear groups was $1.30 (13 widgets), for the positively accelerating groups was .72 (12 widgets), and for the negatively accelerating groups was $1.86 (17 widgets). For the linear groups, when mean widget productivity was 22.3 for group 1 the range of percent of incentive to base pay was 65.5% to 73.0% and 60.0% to 72.2% when the mean was 21.0. When mean productivity was 33.2 for linear group 2 the range of percent of incentive to base pay was 33.3% to 67.7%, and 23.1% to 63.0% when the mean was 32.0. For the positively accelerating groups, when mean productivity was 32.0 widgets for group 3 the range was 79.2% to 89.4%, and 82.5% to 89.0% when the mean was 32.3. When mean productivity was 26.4 for positively accelerating group 4 the range was 72.5% to 88.7% and 72.5% to 89.0% when the mean was 28.2. For the negatively accelerating groups, when mean productivity was 20.2 for group 5 the range was 0.0% to 36.7% and 0.0% to 42.8% when the mean was 22.4. When mean productivity was 27.6 for negatively accelerating group 6 the range was 35.9% to 38.6% and 35.4% to 42.6% when the mean was 30.5.

The results concerning quality are fairly straightforward. The data indicate that quantity improvements did occur under the linear and negatively
accelerating pay systems without quality suffering. Also, there is some evidence to suggest that quality will not be jeopardized when considerable productivity increases occur under the positively accelerating pay system. However, the decrease in quality (going from 2 to 13 errors) observed in group 4 is reason for concern and suggests a need for further investigations of the quality/quantity relationship. There are two plausible explanations for the occurrence of the decrease in quality in group 4. First, the learning curve (flat pay condition) was too short (7 sessions) for those particular subjects. Second, the subjects may have been hurrying to make more widgets to earn more money. Of course, if the latter is the case, then the hypothesis of an inverse relationship between quality and quantity espoused by Adam (1972; 1975) is supported. The data on quality are inconclusive and the issue should be investigated further for definitive conclusions can be drawn.

None of the incentive pay systems proved to be effective at controlling worker absenteeism. The positively and negatively accelerating systems maintained absenteeism at slightly above (+5%) the flat pay condition rates, while greater than an average 50.0% increase in absenteeism occurred for the linear groups. Logically, workers would be expected to come to work more often when they are paid under a monetary incentive pay system since money has been proven to be a motivator of work performance.

After absences, subjects very often offered anecdotal explanations such as illness, car problems, and the need to study for tests. However, since there is no objective evidence for the legitimacy of those explanations, they cannot be relied upon as supporting the efficacy of the power of the incentive pay systems. A more prudent explanation for the higher rate of absences during the linear pay condition is that either money was not an effective motivator for the absent subjects or that there was some competing schedule of reinforcement which produced a more valued reinforcer.

After considering all the data sets in this study, the negatively accelerating pay system is the best option among the incentive systems investigated. The system produced substantial increases in productivity while holding cost increases to a minimum, it produced more consistent performance than did the flat pay condition, and it generated fewer errors. In addition, the negatively accelerating system provides users more flexibility in the design of work settings where both the individual and group arrangements will yield increases in productivity while either further reducing the cost per widget or maintaining the cost at the flat pay rate.

While the results of this study have added to what is already known about individual monetary incentive pay systems, some caution should be
used in interpreting the results given several weaknesses of the study. One limitation on the findings may be a confounding effect due to the subjects' receiving immediate performance feedback. While the feedback may have served as a reinforcer and, thereby, influenced performance in future work sessions, it is unlikely that such feedback would be totally eliminated in the absence of pay sheets. Subjects were observed tracking the number of completed widgets both during and at the conclusion of the work sessions. In addition, subjects were frequently observed sharing the results of work sessions with subjects from other incentive groups. A point of consideration is that even when formal feedback is controlled, self-administered feedback is likely to be present in a real work setting.

Other possible weaknesses were the violation of the multiple baseline design during the work setting change, the short experimental phases in linear group 1 (5 sessions each in the group and individual work settings), and a small sample (2 subjects) in the negatively accelerating group 6. These weaknesses were not part of the experimental design, but occurred due to time limitations, the need to achieve stability prior to introduction of the experimental conditions, and the availability of subjects. Possible solutions include increasing the total number of work sessions and recruiting "stand-by" subjects to replace drop-outs.

GENERAL DISCUSSION

While the four experiments produced mixed results with respect to the level of widget productivity, cost per widget, performance variability, and the most optimal incentive pay system, there were two consistent findings throughout the series of studies. First, the incentive pay systems generated higher levels of productivity than did the flat pay system. This finding is consistent with the results of earlier pay-for-performance investigations. Second, the three incentive systems differentially affected performance levels and cost per widget. Interestingly, this finding is contrary to the results of the Oah and Dickinson (1992) study. In experiment 1 and 2, the linear system produced the greatest gain in widget productivity, whereas in experiments 3 and 4, the positively accelerating system generated the highest levels of productivity. And, while productivity under the negatively accelerating system increased in all four studies, improvements in performance were less substantial. With respect to cost per widget, the negatively accelerating pay system was the most cost effective in three of the four studies (experiments 2 through 4), while the linear system was most cost effective in experiment 1.
With respect to power in generating higher levels of performance while minimizing costs, a pattern has emerged in terms of the most reasonable option for designers of incentive pay systems. In experiments two through four, the negatively accelerating system was considered the best among the three incentive systems, and the system was considered second best in the first experiment. This finding is particularly interesting given the design of the negatively accelerating pay system where each additional widget was worth somewhat less than the previous widget. This finding may be explained simply as an indication that it is not the size of the incentive which controls performance, but rather the fact that there was a pay-for-performance contingency in place.

Because the ability to control performance consistency over time and to minimize radical downward fluctuations from day to day seems to be an essential feature of any incentive pay system, each experiment included a visual analysis of variability patterns within pay conditions. The findings from the series of studies are generally inconclusive with respect to the system which generates less variability. However, one recurring theme was that performance was more consistent during the incentive pay conditions than during the flat pay condition.

Clearly, the data do not favor an individual work setting over a group work setting or vice versa. The best that can be said is that some benefit, in terms of productivity and cost, may be derived by alternating the work setting of individuals paid under the positively and negatively accelerating system. The sequence of the change does not seem to matter. However, until other research on the impact of the work setting is added to what we already know about incentive pay systems, decisions on pay system design would be better guided by the practicality of work setting changes.

A similar reservation is appropriate with respect to the supplemental effects of feedback on incentive pay systems. The data did not provide evidence that the power of the incentive pay systems was in any way strengthened by the addition of feedback. As noted earlier, the physical checking-off activity may have limited the number of widgets that could be made in a work session. Definitive conclusions regarding the supplemental effects of feedback on incentive pay systems must await further research.

Laboratory simulations are frequently criticized for not being relevant to applied settings and, therefore, the external validity of the results are considered tenable with respect to “real world” usefulness. The present studies may be particularly susceptible to such claims given the simplicity of the production task and the inability to generalize results based on the task to more complex tasks and management-type work. Such criticisms
seem less applicable to this series of studies given that Dickinson, LaMere, and Bibly (1991) contend that laboratory simulations employing simple production tasks can be successfully replicated in a real work setting in which the work assignments are complex and of a supervisory nature. Adding further support for the external validity of the results presented here are the data from the debriefing sessions in experiment 4.

**FUTURE RESEARCH**

A consideration of future research should first address the weaknesses identified in the present laboratory studies. The number of work sessions should be beyond twenty-five to allow for a sufficient number of data points within each experimental condition while adhering to the experimental design and stability criterion. The current design could be enhanced by screening subjects with respect to financial need. It seems reasonable to conclude that a more powerful establishing operation (motivational variable) with respect to "need" for money would affect the productivity level of the subject. Knowing this information would make the conclusions concerning the power of the incentive system more clear and more useful. A psychometrically sound questionnaire should be used to collect debriefing data and to perform a manipulation check rather than relying on self-reports during group discussions. The collection of off-task behaviors should be systematic in that research assistants are trained in accurate observation and recording of incidents.

Pay for performance research should continue to focus on the variables identified in these studies and move into non-laboratory settings. First, the supplemental effects of feedback on incentive pay systems should continue to be investigated. However, research efforts will be more useful if they employ a reversal design with formal feedback being introduced after the incentive pay system is in place. Then, if performance increases after the addition of the feedback and decreases after the withdrawal of feedback, the conclusions for supplemental effects would be more convincing. Second, the relationship of the percentage of incentive pay to base pay, particularly in terms of productivity levels when the percentage is greater than 30% of the base pay, should be explored further. A better exploration of the topic would include fixed percentage of incentive to base pay scales. Third, attempts to isolate the impact of the work setting on the effects of incentive pay systems should be continued. While the current studies used four or five subjects per work group, other studies have used as many as ten subjects per work group. Given that a number of businesses now employ profit sharing plans where all members of the organization share
in the incentives (profits) and gain sharing plans where large work groups
share the monetary gains generated by the group, an investigation of
groups larger than ten seems in order. Fourth, isolating the environmental
conditions under which substantial increases in productivity occur while
maintaining acceptable levels of quality will be important to pinpointing
the optimum design criteria.

Further examination of the positively accelerating system may be
worthwhile. Ultimately, the designs of the incentive pay systems were
determined mostly by the structure of incentive systems which had proven
effective in previous studies (e.g., Dickinson, 1991; Leary et al., 1989;
Oah & Dickinson, 1992) and to some extent on the amount of funding
available for the studies. However, changes to the pay scales may prove to
be useful. For instance, changing the temporal arrangement of the pay
scale to a slower acceleration may result in more valuable increases in
productivity and a slower incremental growth rate in the cost per widget. If
the positively accelerating pay system under such a slower rate continues
to control higher levels of productivity, then the system may become a
more attractive design option.

Continued investigation of the linear system also seems appropriate.
The system has potential because of its ability to significantly increase
productivity and yield predictable costs. If the cost per widget can be
better controlled while higher levels of productivity are maintained, the
linear system may also become a practical alternative to the flat pay
system.

The examination of situational factors within organizations will provide
opportunities for extending the pay for performance research. For exam-
ple, the need to quickly gain the lion’s share of a consumer market or the
need to develop productivity and cost stability may dictate which incentive
pay system is most desirable. Another situational factor which provides a
fertile ground for incentive research is the social psychology phenomenon
of “social loafing.” “Social loafing,” as coined by Latané, Williams and
Harkins (1979) occurs when the sum of the performance of individuals
working in a group co-action setting is less than the sum of those same
individuals when working alone. The conceptions of social loafing, such as
“absence of evaluation apprehension” (Jackson & Harkins, 1985),
“hide-in-the-crowd” and “free-rider effect” (Kerr & Bunn, 1981), and
“sucker effect” (Kerr, 1983), suggest that in collective settings worker
motivation is diminished in some way by the presence of other workers.
Given the proliferation of work teams in business and industry, an inves-
tigation of the existence of social loafing is imperative. And, given that the
linear, positively accelerating, and negatively accelerating incentive sys-
tems have proven successful in improving performance, the investigation of the usefulness of the systems in eliminating social loafing behavior is important.

Incentive pay systems are one piece of an organization's compensation system and the compensation system is but one piece of the total performance management program in any organization. According to Gilbert's BEM (1978), there are many things, such as environmental supports and personal repertoire, which constitute the entire program. However, without an effective motivation system, these factors may be ineffective at managing performance.

REFERENCES


APPENDIX A. The Total Pay Earned by Subjects in Experiments 1 Through 4.

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APPENDIX B. Graphically Illustrated Incentive Pay System Curves in Experiments 1 Through 4.