Performance on a Data Entry Task When Participants Receive Three Different Types of Graphic Feedback

Sarah E. VanStelle

Western Michigan University, sarah.vanstelle@gmail.com

Follow this and additional works at: http://scholarworks.wmich.edu/dissertations

Part of the Psychology Commons

Recommended Citation

VanStelle, Sarah E., "Performance on a Data Entry Task When Participants Receive Three Different Types of Graphic Feedback" (2012). Dissertations. 125.
http://scholarworks.wmich.edu/dissertations/125

This Dissertation-Open Access is brought to you for free and open access by the Graduate College at ScholarWorks at WMU. It has been accepted for inclusion in Dissertations by an authorized administrator of ScholarWorks at WMU. For more information, please contact maira.bundza@wmich.edu.
PERFORMANCE ON A DATA ENTRY TASK WHEN PARTICIPANTS RECEIVE THREE DIFFERENT TYPES OF GRAPHIC FEEDBACK

by

Sarah E. VanStelle

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Philosophy
Department of Psychology
Advisor: Alyce Dickinson, Ph.D.

Western Michigan University
Kalamazoo, Michigan
December 2012
PERFORMANCE ON A DATA ENTRY TASK WHEN PARTICIPANTS RECEIVE THREE DIFFERENT TYPES OF GRAPHIC FEEDBACK

Sarah E. VanStelle, Ph.D.
Western Michigan University, 2012

This purpose of the present study was to compare the effects of three types of graphic feedback on worker performance and satisfaction. The first type displayed individual performance (IF), the second displayed individual performance and average group performance (SCF-GA), and the third displayed individual performance for each individual in the group (SCF-IP). Participants were 54 undergraduate students who were randomly assigned to one of the three groups. They performed a computerized data entry task that simulated the job of a medical data entry clerk. The primary dependent variable was the number of correctly completed patient records. Secondary dependent variables included: (1) time on-task, (2) accuracy, and (3) data entry rate. The first session was used as a covariate to control for keyboard skills and a monotone ANCOVA was used to determine whether performance differed among the groups. A post-study questionnaire was used to assess performer satisfaction, and ANOVAs were conducted to determine whether satisfaction differed. There was a statistically significant difference in the performances of each group, in ranked order: IF < SCF-GA < SCF-IP. There were no statistically significant differences found for any of the satisfaction questions. Collectively, these results imply that organizations would gain maximum performance
increases by providing graphic feedback that displays the individual performances of each individual. Results also showed that under these particular experimental conditions, participants did not find the SCF-IP any more aversive than IF or SCF-GA. Participant performance, participant satisfaction, and suggestions for future research are discussed in detail.
ACKNOWLEDGMENTS

As I reflect on my graduate career at Western Michigan University, I realize how fortunate I am to have so many wonderful and supportive people in my life. I would like each of you to know how much you mean to me, and to realize that I could not have accomplished this without each one of you. Thank you all so much for helping me through the difficult times, cheering me on when I was down, and celebrating with me each step of the way. I have never had one moment where I didn’t feel the love and encouragement from all of you, and for that, I am truly grateful.

Alyce, Heather, Brad, and Kevin, thank you for serving as my committee, and for the continuous encouragement and support. I appreciate the guidance and mentorship throughout the years, and value each of you not only as a professional in the field, but as a friend. Alyce, as you say, I ended up where I was always supposed to be.

There are too many of my friends to call out, this tells me how lucky I am! I appreciate the sympathetic ears when I needed them, and the nights out to relax when I “deserved” a break. To my running friends, my graduate school friends, my work friends, my long-time friends, thank you for making me smile when I needed it most.

My invaluable family: John and Paula VanStelle, Jerome and Jody Bajo, Brandon, Brittany and Shannon. I appreciate all the laughter and encouragement that you have provided throughout my lifetime. I want you to know that each of you has helped to shape the person that I am today, and I am so glad that you did. Brandon, Brittany, and
Shannon: I know that each of you have many great things to accomplish in your life. I hope that you always look to me for strength and inspiration; know that you can do anything.

Lastly, I would thank Phil. The continuous encouragement that you have provided cannot even be put into words. You have stood by my side through an entire graduate career, and you have always believed in me, supported me, and loved me. You wiped away tears of frustration, and smiled with me through tears of joy. I am so thankful for everything that you have done for me, and for being my hero.

Sarah E. VanStelle
**TABLE OF CONTENTS**

ACKNOWLEDGMENTS .............................................................................................. ii

LIST OF TABLES .................................................................................................... vii

LIST OF FIGURES ................................................................................................ viii

INTRODUCTION ...................................................................................................... 1

  Graphic Individual Feedback (IF) ................................................................. 8
  Graphic Social Comparison Feedback-Group Average (SCF-GA) ............ 9
  Graphic Social Comparison Feedback-Individual Performance (SCF-IP) . 13
  Competition ........................................................................................................ 15
  Summary and Rationale ..................................................................................... 20

METHOD .................................................................................................................. 23

  Participants ......................................................................................................... 23
  Setting .................................................................................................................. 24
  Apparatus ........................................................................................................... 24
  Dependent Variables .......................................................................................... 25
  Independent Variable ......................................................................................... 27

    Individual feedback ......................................................................................... 27

    Social comparison feedback-group average .............................................. 27

    Social comparison feedback-individual performance ............................ 28

Experimental Design ............................................................................................ 28

Statistical Analysis ............................................................................................... 29

Experimental Procedures .................................................................................... 29
Table of Contents-Continued

Random assignment ................................................................. 29
Introductory session ................................................................. 30
Experimental sessions ......................................................... 31
Debriefing session ..................................................................... 31
Integrity of the Independent Variable .................................... 32

RESULTS .................................................................................. 33
Primary Analyses ..................................................................... 33
Secondary Analyses ................................................................ 34
Effects on High, Middle, and Low Performers ..................... 36
Preference, Satisfaction, and Stress ..................................... 37

DISCUSSION ............................................................................. 39
Participant Performance ......................................................... 42
Participant Satisfaction ........................................................... 43
Strengths of the Study ............................................................... 46
Weaknesses of the Study .......................................................... 46
Future Research ....................................................................... 47

REFERENCES ........................................................................... 49

APPENDICES
A. HSIRB Approval Letter .......................................................... 60
B. Participant Recruitment Script ............................................. 62
C. Participant Recruitment Flyer ............................................... 64
<table>
<thead>
<tr>
<th>Section Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Study Inclusion Questionnaire</td>
<td>66</td>
</tr>
<tr>
<td>E. Informed Consent Form – IF and SCF-GA</td>
<td>68</td>
</tr>
<tr>
<td>F. Informed Consent Form – SCF-IP</td>
<td>72</td>
</tr>
<tr>
<td>G. Screenshot of Apparatus</td>
<td>76</td>
</tr>
<tr>
<td>H. Participant Questionnaires</td>
<td>78</td>
</tr>
<tr>
<td>I. Interview Questions</td>
<td>82</td>
</tr>
<tr>
<td>J. Sample of Individual Feedback Graph</td>
<td>84</td>
</tr>
<tr>
<td>K. Individual Feedback – Instructional Script</td>
<td>86</td>
</tr>
<tr>
<td>L. Sample of SCF-GA Graph</td>
<td>88</td>
</tr>
<tr>
<td>M. SCF-GA – Instructional Script</td>
<td>90</td>
</tr>
<tr>
<td>N. Sample of SCF-IP Graph</td>
<td>93</td>
</tr>
<tr>
<td>O. SCF-IP – Instructional Script</td>
<td>95</td>
</tr>
<tr>
<td>P. Informed Consent Script</td>
<td>98</td>
</tr>
<tr>
<td>Q. Evaluation/Training for Classification of Decimals</td>
<td>101</td>
</tr>
<tr>
<td>R. First Session Script for All Participants</td>
<td>110</td>
</tr>
<tr>
<td>S. Receipt for Compensation</td>
<td>112</td>
</tr>
<tr>
<td>T. Debriefing Scripts</td>
<td>114</td>
</tr>
<tr>
<td>U. Open-Ended Responses for All Participants</td>
<td>118</td>
</tr>
</tbody>
</table>
LIST OF TABLES

1. Raw Means for Number of Correctly Completed Patient Records .......... 33
2. Adjusted Means for Number of Correctly Completed Patient Records .... 34
3. Source Table for Analysis of Covariance ............................................. 34
4. Means and Standard Deviations for Time on Task, Accuracy, and Rate .. 35
5. Correlations Between Number of Correctly Completed Patient Records, Time on Task, Accuracy, and Rate................................................. 35
6. Means and Standard Deviations for Questionnaire Items (1=low and 5=high) ................................................................................................. 38
LIST OF FIGURES

1. Estimated mean change scores by group and performance level .................. 36
INTRODUCTION

Organizations are continuously looking for effective ways to impact employee performance and subsequently, business revenue; organizational behavior management (OBM) interventions offer numerous solutions. Performance feedback interventions have been particularly popular. In reviews of studies published in the *Journal of Organizational Behavior Management*, Balcazar, Shupert, Daniels, Mawhinney, and Hopkins (1989) and Nolan, Jarema, and Austin (1999) found that feedback was the most frequently used intervention, having been adopted in 65% and 71% of the studies, respectively. VanStelle et al. (2012), in the most recent review, also found feedback to be the most commonly used intervention, having been adopted in 68% of the studies published between 1998 and 2009. Several factors help to explain this widespread use: Performance feedback is relatively simple to implement, cost-effective, and can increase performance quickly (Prue & Fairbank, 1981; Rohn, Austin, & Lutrey, 2002).

Despite the popularity of performance feedback, the term remains problematic. Feedback interventions vary considerably, yet both researchers and practitioners continue to use the term in an overarching way as if referring to a single procedure or intervention (Houmanfar & Hayes, 1998). A further complication is that individuals in business often use the term differently than those trained in OBM. For example, managers may regard annual performance appraisal reviews as feedback or may overlook informal feedback procedures such as task specific praise and peer comments.

Prue and Fairbank (1981), in one of the first reviews of the use of performance feedback in OBM, maintained that in order to consider an intervention feedback, information must be provided to individuals or groups about the quality and/or quantity
of performance. This broad definition of feedback has remained the same over the past three decades within the OBM field. For example, Rummler and Brache (1995) defined feedback as information that tells performers both what they are doing and how well they are doing it, and Braksick (2007) defined it as information that is given to performers, or a group of performers, that informs them about their behaviors and the impact of those behaviors. Although worded slightly differently, most definitions used within the field of OBM have two common features: Performance feedback is dependent on the past performance of the individual or group and its purpose is to guide or alter future performance (Johnson, 2005).

In his attempt to define feedback, Tosti (1986) identified both intended purpose and possible behavioral function, classifying feedback as either formative or summative. Tosti described formative feedback as changing the quality of performance by correcting, guiding, and improving it. He also stated that formative feedback functions as an antecedent stimulus and should be delivered immediately before performance to have the most impact. Conversely, the purpose of summative feedback is to change the quantity of performance. Tosti stated that summative feedback functions as a consequence, and should be delivered immediately after performance (Tosti, 1978, 1986).

As Tosti’s (1978, 1986) explanation outlines, it seems that feedback can have at least two different behavioral functions. However, there is not a clear consensus among researchers regarding the possible behavioral function(s) of feedback. There are a few reasons why this analysis is complicated.

1) Presentation of feedback: Feedback is delivered both before and after behavior.

That is, when feedback is delivered, it is provided for on-going behavior; the
presentation of the feedback follows previous behaviors but also precedes future behaviors.

2) The delay between feedback and the response: Work-related behaviors are not immediately evoked upon the presentation of feedback.

3) The delay between performance and feedback: Feedback is often provided well after the performance occurs.

These complications have led to numerous proposals regarding behavioral functions. Prue and Fairbank (1981) suggest that feedback, when first presented, may initially function as a discriminative stimulus (SD), which sets the occasion for work related behaviors. Balcazar, Hopkins, and Suarez (1985-86) explain this in terms of generalization from past behavioral relations. That is, in the past, a person’s behavior may have been differentially consequated when feedback was present and when it was absent; this could generalize to the present situation. Thus, when feedback is presented with existing consequences, it may evoke increased responding. The increased levels of responding may then be reinforced and maintained by those additional consequences. Because of this, the feedback may acquire discriminative control in the current situation as well.

Another possibility is that feedback may function as a conditioned reinforcer. Feedback may be delivered in conjunction with additional reinforcers (Balcazar et al., 1985-86). If so, these pairings could result in feedback becoming a reinforcer itself. Additionally, feedback may function as a motivating operation (Bucklin, McGee, & Dickinson, 2003; Duncan & Bruwelheide, 1985-86; Peterson, 1982). Feedback may
increase the reinforcing value of work-related consequences, and thus, may evoke behaviors that have resulted in those consequences.

Feedback may also be explained in terms of rule governed behavior (Agnew & Redmon, 1992; Bucklin et al., 2003; Malott, 1992). Researchers who promote this analysis claim that the temporal delay between the feedback and response or between the response and the feedback is too great (often being days or weeks) for the feedback to function as a direct-acting SD or conditioned reinforcer. Rather, the feedback would instead function more as “instructions” with its effects being verbally mediated (Krumhus & Malott, 1980; Michael, 2004).

Perhaps, Peterson (1982) captured the possible behavioral functions of feedback best when he stated:

It [feedback] is, first and foremost, a physical stimulus, irrespective of which form it takes, and therefore could have some or all of the possible effects of any stimulus. Given the proper history of conditioning, it could be a conditioned reinforcer, a conditioned punisher, a discriminative stimulus, a conditioned stimulus in a respondent paradigm, or an establishing stimulus (Michael, 1982).

(p. 101)

In spite of the fact that there are complications identifying the specific behavioral functions of feedback, the intervention remains popular, as outlined in the literature reviews above. But, even though the intervention is popular, different types of feedback procedures have not been adequately evaluated. Evaluation has been hindered by three factors: (a) feedback procedures are often used with other interventions (i.e., goal setting and rewards), (b) different feedback procedures are often used together (i.e., verbal praise
and graphic feedback), and (c) feedback procedures vary along many different
dimensions (i.e., individual vs. group, written vs. graphic, private vs. public).

In the first systematic attempt to evaluate the effects of different types of feedback
procedures, Balcazar et al. (1985-86) reviewed applied studies that had been published in
four major journals, classifying the feedback procedures according to several dimensions
and determining the effectiveness of the procedures by dimension. Balcazar et al. found
that feedback was used alone in only 37% of the studies. Alvero, Bucklin, and Austin
(2001) updated this review, replicating the procedures used by Balcazar et al., for applied
studies published in the same journals between 1985 and 1998. They reported that this
trend had continued, with feedback being used alone in only 29% of the studies. Unlike
Balcazar et al., Alvero et al. identified the types of feedback used in each study and the
other interventions used along with them. Based on these data, the author determined that
even when feedback was reported as being used alone, there were often multiple types of
feedback used; only 16% (N=11) of studies used one type of feedback. In their more
recent review, VanStelle et al. (2012) found that different feedback procedures were used
together in all of the feedback studies (N=52).

It is not surprising that package interventions are often used in applied settings.
Business managers typically want to improve performance as quickly as possible; every
day without improvement may adversely affect key business results or finances. Thus,
they are often unwilling to implement procedures that might improve performance or that
might take a long time to improve performance. In addition, OBM researchers and
practitioners are more likely to recommend interventions that combine feedback with
other components because the literature suggests that they are more effective than when feedback is used alone (Alvero et al., 2001; Balcazar et al., 1985-86).

While the existing reviews of feedback provide useful guidance, conclusions are based on the formal analyses of procedures that varied along many different dimensions. For example, in both Alvero et al. (2001) and Balcazar et al. (1985-86), displays classified as graphic feedback contained different content (e.g., individual performance, group performance, and both individual and group performance), and were provided privately, publicly, or both privately and publicly. Both the content and public/private nature of the feedback could influence the effectiveness of graphic displays. In addition, in both the Balcazar et al. and Alvero et al. reviews, only a small number of feedback applications were included in each category. For example, in Alvero et al. there were four or fewer applications in nine of the twelve content categories (the type of information provided on the feedback display). This also makes conclusions from these reviews problematic.

Only systematic comparisons wherein specific characteristics are held constant while others are varied can ultimately determine whether different types of feedback affect performance differently. To illustrate this problem, Balcazar et al. (1985-86) found that displays depicting group performance and those depicting both individual and group performance had similar effects on performance, while Alvero et al. (2001) found that feedback displays depicting group performance had considerably better effects than those depicting both individual and group performance. Yet Goltz, Citera, Jensen, Favero, and Komaki (1989), in an experimental analysis, found that graphic displays of individual and
group performance resulted in significantly better performance than graphic displays of
group feedback.

The purpose of this study was to compare three different types of graphic feedback displays; those that depicted (a) individual feedback (IF), (b) social comparison feedback – group average (SCF-GA), and (c) social comparison feedback – individual performance (SCF-IP). Graphic feedback depicting individual performance was selected as one of the conditions because both Balcazar et al. (1985-86) and Alvero et al. (2001) reported that (a) graphic feedback resulted in the highest levels of consistent effects, alone (Balcazar et al., 1985-86) or in combination with verbal or written feedback (Alvero et al., 2001), and (b) feedback on individual performance was the most common type of feedback provided. Further, with respect to the latter, individual feedback provides more specific information about the individual’s own performance than displays of group performance, which has been cited as an advantage (Daniels & Daniels, 2004; Goltz et al., 1989).

The graphic individual performance display also served as an experimental control for the other two conditions; that is, graphic individual performance feedback was provided in all three conditions. Each of the other two feedback conditions provided additional information, namely, how well the individual was performing in comparison to average group performance or how well he or she was performing in comparison to all of the other workers. Selection of these two conditions was guided by the results of studies that will be described later. Studies that have examined these three types of feedback displays are discussed below, followed by the rationale for this study.
Graphic Individual Feedback (IF)

Graphic individual feedback, when combined with other interventions, has increased performance in a variety of settings; i.e., a hospital, manufacturing firm, medical clinic, and offices within a university (e.g., Batemen & Ludwig, 2003; Culig, Dickinson, Lindstrom-Hazel, & Austin, 2008; DeVries, Burnette, & Redmon, 1991; Slowiak, Madden, & Mathews, 2005). As an example, Culig et al. used graphic individual feedback along with workstation redesign, information, and praise to increase safe ergonomic behaviors of seven office workers. The graphic feedback displayed the participant’s percentage safe score for each posture. After baseline, the workstations were redesigned. The performance management package (information, feedback, and praise) was then implemented, and the targeted postures increased for all seven participants, with increases ranging from 54% to 80%.

The author was able to locate only one published study that isolated the effects of this type of feedback: Wilk and Redmon (1998). In that study, Wilk and Redmon used a combination of verbal feedback, graphic feedback, and goal setting to increase the productivity of 16 clerical employees in a university admissions department. A multiple baseline design across four work areas (filing, mailroom, credit evaluation, and data entry) was used to evaluate the effects of the interventions. Following baseline, the supervisor met with each employee two times a day. In the morning, she set an individualized goal regarding the number of tasks to be completed and provided verbal feedback on the previous day’s performance. In the afternoon, she met with the employee again, providing feedback. In the next phase, the supervisor provided graphic feedback
along with verbal feedback when she set the daily goal in the morning. Follow-up data were collected periodically for 30 weeks after the researchers left the project site.

The average number of tasks completed each week for each work area increased considerably when individualized goal setting and verbal feedback were implemented: from 983 to 1,703 in filing, 5,077 to 8,822 in the mailroom, 685 to 861 in credit evaluation, and 582 to 994 in data entry. Despite these large increases, average performance increased again when graphic feedback was added: to 4,188 in filing, 13,389 in the mailroom, 1,049 in credit evaluation, and 1,243 in data entry. Performance maintained during follow-up. Efficiency measures, defined as the number of tasks completed per labor hour, showed the same pattern in each unit. These data suggest that graphic individual feedback can greatly enhance performance.

**Graphic Social Comparison Feedback – Group Average (SCF-GA)**

Similar to graphic individual feedback, graphic social comparison feedback that displays both the individual’s performance and the group’s performance, has improved performance in a variety of settings; i.e., a roofing firm, hospital, bank, manufacturing firm, and an electronics firm (Austin, Kessler, Riccobono, & Bailey, 1996; Babcock, Sulzer-Azaroff, Sanderson, & Scibak, 1992; Brown & Sulzer-Azaroff, 1994; Emmert, 1978; Goltz et al., 1989). In two of these studies, Austin et al. and Babcock et al. implemented graphic individual and group feedback along with goal setting and rewards. In both, performance increased dramatically; however, the effects of the feedback cannot be isolated from the effects of the other components.

Brown and Sulzer-Azaroff (1994), in contrast, examined the effects of feedback alone on the customer service behaviors of three tellers. Their feedback intervention
consisted of graphic individual feedback and graphic group feedback. The researchers targeted three behaviors: smiling, greeting, and looking at customers when they arrived at the bank. During baseline, the frequencies of the three behaviors were measured. In the next phase, tellers gave a poker chip to each customer and asked the customer to rate his or her satisfaction by placing the chip in a survey box located by the exit. Each teller had a different colored poker chip which was distinctive to him or her, and allowed individual performance ratings to be identified. Five slots in the box were labeled with varying levels of satisfaction from “extremely satisfied” to “unsatisfied.” At the end of each experimental session, researchers collected the poker chips from the box and recorded the number of chips of each color found in each category. Tellers were not given any feedback during this second phase. The next two phases consisted of a return to baseline, and then a reinstatement of the poker chips. During the final phase, which was the feedback phase, tellers were told what behaviors were being observed, and were given graphs of their individual performance in sealed envelopes. In addition, a graph displaying group performance was publicly posted. The graphs displayed both the percentages of correctly performed behaviors and average customer satisfaction levels. The branch manager reported that she praised the tellers for participation and performance, both informally and formally during a formal staff meeting that occurred in this final phase, although this was not part of the intervention planned by the researchers.

The poker chip intervention increased the mean percentages of smiling, greeting, and looking at customers by 56%, 60%, and 10%, respectively, over the baseline means, but its effects varied widely from teller to teller. Addition of the feedback increased the mean percentages of smiling, greeting, and looking at customers further, by 89%, 14.4%,
and 18.2%, respectively, over the poker chip intervention. Although the effects of the individual and group feedback were not isolated, the results of this study indicate that this type of combined feedback procedure can effectively increase performance.

Two studies (Emmert, 1978; Goltz et al., 1989) have examined whether graphic individual feedback enhances the effects of graphic average group performance feedback. Emmert, after a baseline of four weeks, implemented a group goal and graphic group feedback for four manufacturing crews. The productivity of the four crews was plotted on one graph and publicly displayed. Private graphic individual feedback was then added to the group feedback in a staggered fashion across the four crews. The group feedback and goal setting improved the performance of only two of the four crews. When individual feedback was provided, the performance of those two crews improved further; however, the performance of the other two crews remained at or below baseline level. These data are hard to interpret because the effects were inconsistent across crews and about one-third of the workers were replaced during the study. Regardless, they suggest that individual feedback may augment the effects of graphic group performance feedback.

Goltz et al. (1989) found that the performance of 20 workers in an electronics plant improved when they were given graphic individual performance feedback in addition to graphic average group performance feedback. In contrast to Emmert (1978), this was a well-controlled study.

Goltz et al. (1989) targeted correct product and part handling using an ABCB design. Following baseline, researchers met with workers individually each day, showing them a chart that displayed whether all workers had performed each targeted behavior correctly. Each week, researchers also showed workers (again privately) a cumulative
graph that displayed the group’s daily overall percentage scores across all of the targeted behaviors. In the next phase (Phase C), researchers gave workers charts and graphs that displayed their individual performance along with the group charts and graphs. The final phase was a reversal phase in which only group feedback was provided.

During baseline, the average percentage of correct handling behavior was 83.6%. This rose to 90.6% when group feedback was provided and to 96.4% when individual feedback was added. Both increases were statistically significant with $p < .001$. When individual feedback was removed, the average decreased slightly to 95.2%, but the decrease was not statistically significant.

The significant increase in performance after individual feedback was added suggests that the individual feedback enhanced the effects of group feedback. However, as noted by Goltz et al. (1989), these results should be interpreted cautiously due to the lack of reversal. Goltz et al. suggested that performance might not have reversed because the individual feedback could not really be removed; that is, that it served a training function and altered the way workers performed the tasks. Goltz et al. further suggested that future researchers might be able to clarify the effects of group and individual feedback using a different research design; one that did not involve a reversal phase.

The author of the current study chose to examine graphic individual and group performance feedback rather than graphic group performance feedback (alone) because of the results of Emmert (1978) and Goltz et al. (1989). Even though the results of these studies were not definitive, they suggest that individual feedback can enhance the effects of group feedback. Thus, if providing the two together does not result in higher levels of performance than graphic individual feedback (one of the other two conditions in this
study), it is unlikely that graphic group feedback alone would do so. Another reason for selecting this condition was that the author was not able to locate any study that has examined whether graphic group feedback enhances the effects of graphic individual feedback; a comparison the current study will permit.

**Graphic Social Comparison Feedback – Individual Performance (SCF-IP)**

Several researchers have used a type of social comparison feedback, called public normative feedback by Camden, Price, and Ludwig (2011), in which the performance of each worker is displayed on a graph or chart and identified by name or code (Anderson, Crowell, Doman, & Howard, 1988; Anderson, Crowell, Hantula, & Siroky, 1988; Anderson, Crowell, Sponsel, Clarke, & Brence, 1982; Camden et al., 2011; Crowell, Anderson, Abel, & Sergio, 1988; Ludwig & Geller, 2000). Similar to other types of graphic feedback, this type has been shown to increase performance when combined with other interventions, such as goal setting and rewards (Anderson et al., 1982; Bateman & Ludwig, 2003; Camden et al., 2011; Rose & Ludwig, 2009; Stephens & Ludwig, 2005).

Two studies have examined the effects of this type of feedback by itself, even isolating its effects from task clarification, which is typically confounded with feedback (Anderson, Crowell, Hantula, & Siroky, 1988; Crowell et al., 1988). Both found that this type of feedback increased performance after task clarification had been implemented.

In one of these studies, Anderson, Crowell, Hantula, and Siroky (1988) targeted cleaning behaviors of 30 student workers in a university bar. During task clarification, checklists relevant to specific areas of the bar were posted. All checklists were posted at the same time. Following that, workers were divided into three groups, and line graphs displaying the performance of each group member, coded by numbers, were publicly
posted. Graphs were updated daily. Public posting of the three graphs was staggered in time across the groups. Because the feedback was publicly posted, the researchers anticipated that generalization across groups might occur, but reasoned that this was a way to at least partly assess the causal influence of the feedback separate from the task clarification. In an attempt to minimize or eliminate effects due to other variables, the authors noted that they never set or mentioned goals, and did not include social or tangible consequences for increases in performance as part of the intervention. They also tried to offset avoidance contingencies by making participation voluntary, securing management agreement that the performance data would not be used to criticize staff or threaten their jobs, and telling staff about that agreement.

Task clarification increased performance by 13%. Public feedback posting for the first group produced an abrupt average improvement of 37% with corresponding improvements of 21% and 24% in the other two groups, suggesting that generalization did occur. However, the performance of the second and third group abruptly increased further when feedback was publicly posted for the respective group, strongly suggesting that the feedback was responsible for the increases. By the end of the feedback phase, performance was an average of 65.3%, 56.3%, and 63.6% higher for Groups 1, 2, and 3, respectively, than baseline averages. The results of this study demonstrate that this type of feedback can result in meaningful increases in performance absent explicit goal setting and tangible consequences.

Ludwig, Geller, and Clarke (2010) examined the additive effects of this type of feedback after group feedback and goal setting had been implemented, using a multiple baseline design across settings. The targeted behavior was turn-signal use by pizza
deliverers. During the group feedback and goal setting phase, the group’s average weekly performance was publicly posted on a graph that included a goal line. During the next phase, the average weekly individual performance of each worker was added to the graph, identified by name. Deliverers in the first store (N=24) increased their use of turn signals from an average of 5% during baseline to 16.9% during the group feedback phase, and then to 30% during the individual feedback phase. Deliverers in the second store (N=20) increased their performance from an average of 28.9% during baseline to 43.6% during the group feedback phase, and to 56% during the individual feedback phase. Thus, similar to Goltz et al. (1989), the individual feedback enhanced the effects of group feedback.

**Competition**

Competition is a variable that was inevitably related to some of the conditions of this study, most notably, the SCF-IP group. Though competition is very prevalent in our everyday lives, there has been little direct research on competition; the emphasis has traditionally been on cooperation (Buskist & Morgan, 1988). There are numerous reasons for the focus on cooperation, but the predominant factor is that “competition has been known to produce negative emotional and behavioral by-products” (p. 168) and that “competition increases quantity but not quality of performance” (p. 169). In their extensive review of studies on competition, Buskist and Morgan (1988) describe different definitions of competition, but conclude that competition is a complex relationship between two or more people with respect to a common event or stimulus which cannot be divided equally among the parties.
The majority of the research on competition comes from three areas: nonhuman animal research, social psychology gaming literature, and research from an operant reinforcement perspective. Additionally, most of the research from each of the three areas has focused on the “choice” to cooperate versus compete.

It is unlikely that research with nonhuman animals adequately generalizes to the complex relationships between competing humans. In addition, this research has resulted in inconsistent findings, and therefore even the conclusions drawn about nonhuman competition are problematic. For examples of this type of research, see Bayroff, 1940; Church, 1961, 1962; Lepley, 1937; Winslow, 1940.

The social psychology literature has examined “matrix games” which vary by study, but in general, participants are provided with a conflict in which they can choose to cooperate with, or compete against each other in order to capitalize on the payouts. Historically researchers have identified task variables, situational variables, or personality variables that are correlated with competitive or cooperative behaviors. Findings in this area have included that the following variables are related to the choice of whether or not individuals choose to engage in competitive or cooperative behaviors: Duration of the game (Morehous, 1966), level and type of communication among participants (Swensson, 1967; Wichman, 1970), game instructions given (Evans, 1964), and the relationship among participants (Schoeninger & Wood, 1969; Swingle & Gillis, 1968).

The nature of these results are strictly correlational and do not necessarily provide manipulable variables that can precisely identify when competition will occur.

The third type of research, conducted from an operant reinforcement perspective, has corroborated earlier findings in a more concrete manner. This body of research has
used varying reinforcement schedules (i.e., FI, DRL, FR) to study competition. The majority of this research has demonstrated that preference for competition over cooperation can be manipulated by the magnitude of reinforcers (Matthews, 1979; Schmitt, 1976; Schmitt & Marwell, 1971) and response requirements (Hake, Olvera, & Bell, 1975; Olvera & Hake, 1976). Other conclusions include:

1) Orienting instructions to compete vs. cooperate can speed up the acquisition process, but are unnecessary to generate competition (Buskist, Morgan, & Rossi, 1984).

2) Individuals will inevitably engage in competitive behaviors when exposed to a competitive schedule. Additionally, the specific schedule used will affect competitive performance differently based on the unique properties of the respective schedule (Buskist & Morgan, 1988).

3) Individuals are more likely to compare themselves to other individuals of similar ability (Hake, Vukelich, & Kaplan, 1973; Vukelich & Hake, 1974).

In addition to the conclusions drawn above, Buskist and Morgan (1988) discussed three different dimensions of competition that could affect whether competitive contingencies result in negative emotional or behavioral by-products: interactive versus non-interactive, individual versus team, and minimal versus maximal competition. Interactive versus non-interactive refers to whether one individual’s success interferes with another’s; i.e., whether one individual can hinder another by performing well. To help explain this dimension, Buskist and Morgan identified tennis and football as interactive (a successful defensive behavior by one individual can interfere with an offensive behavior by another) and bowling and golf as non-interactive (individuals do
not interfere with each other’s behavior, although good or exceptional performance by an individual can affect the other). Individual versus team refers to whether success relies on the individual’s own performance or the performance of team members (e.g., golf and bowling versus football and basketball). Minimal versus maximal competition refers to the distribution of reinforcement at the end of competition, with minimal competition resulting in relatively equitable reinforcement distribution and maximal competition resulting in highly differential reinforcement distribution. It is likely that competitive contingencies that are non-interactive, individual, and minimal result in few, if any, negative emotional and behavioral by-products while contingencies that are interactive, team, and maximal are likely to result in the greatest number of negative emotional and behavioral by-products.

The type of SCF-IP implemented in OBM studies (e.g., Anderson, Crowell, Doman, & Howard, 1988; Anderson, Crowell, Hantula, & Siroky, 1988; Crowell et al., 1988) has been non-interactive and individual. It is more difficult to classify these interventions as minimal or maximal competition. Although current monetary reinforcers were equitable, social reinforcers (i.e., praise and criticism) and subsequent organizational rewards (i.e., pay increases, promotions, and in extreme situations retention versus termination) could be highly differential, or perceived to be so by employees. SCF-IP could fall anywhere along the minimal-maximal continuum depending on the particular individuals and organization, but probably falls somewhere in-between minimal and maximal. Based on this analysis, it is unknown whether SCF-IP is likely to produce negative emotions and behaviors.

Guerin’s (1994, 1999) analysis of research on social facilitation and social loafing
suggests that SCF-IP may be more aversive than SCF-GA, and that SCF-GA may, in turn, be more aversive than IF due to differing social contingencies. There are two dominant mediating factors that affect both social facilitation and social loafing: (a) identifiability, i.e., whether an individual’s performance can be identified, and (b) evaluation, i.e., whether an individual’s performance is explicitly evaluated by the group, an experimenter, or a supervisor (Guerin, 1994, 1999; Szymanski & Harkins, 1993). Social facilitation occurs when either or both are present; social loafing is eliminated when either or both are present. Guerin attributes these results to generalized social contingencies, supplemented by verbal rules; in the past, good performance has led to social approval and poor performance has led to social disapproval. Guerin further argues that it is likely that individuals develop rules that concentrate on the avoidance of social disapproval and criticism for poor performance or noncompliance rather than developing rules that concentrate on social approval for good performance or compliance. Guerin’s supposition is partly based on the results of social facilitation studies conducted by traditional social psychologists on “evaluation apprehension.” He notes, however, that although these studies have confirmed that individuals alter their behavior to avoid negative consequences, researchers have not experimentally manipulated positive versus negative outcomes; thus his conclusions are tentative. If Guerin’s conclusions are true, individuals may perceive (a) SCF-IP as more aversive than SCF-GA and (b) SCF-GA as more aversive than IF, due to the potential for additional social disapproval and evaluation by peers.

Guerin’s (1994, 1999) analysis implies that low performers might find social comparison feedback more aversive than high performers. However, studies conducted
by Steigleder, Weiss, Cramer, and Feinberg (1978) suggest that SCF-IP might be aversive to individuals regardless of whether they are high or low performers. Steigleder et al. conducted five studies to determine whether responses that terminated competition showed the same properties as escape responses. In two of these studies, Steigleder et al. found that both high and low performers terminated competition when they were given the opportunity to do so. Participants who were led to believe that they were in the 20th percentile terminated competition more quickly than those who were led to believe that they were in the 90th percentile, but the latter also chose to terminate competition. The authors concluded that the results of the five studies, taken together, “revealed a striking point-to-point correspondence between the effects of a reinforcer in escape conditioning and the effects of competition cessation in competitive performance” (p. 1291). Although these results do not address whether individuals will perform better in competitive situations, they do suggest that because of competition SCF-IP is likely to be more aversive to individuals than either SCF-GA or IF.

**Summary and Rationale**

Graphic feedback displays depicting individual performance, individual performance with the group’s average performance, and the individual performance of each performer have all been shown to increase performance (Goltz et al., 1989; Anderson, Crowell, Hantula, & Siroky, 1988; Wilk & Redmon, 1998). Further, individual feedback has been shown to enhance the effects of group feedback (Goltz et al., 1989; Ludwig et al., 2010). However, before the current study the effects of these three feedback procedures had not been directly compared, nor had studies examined whether
average group performance feedback enhances the effects of individual feedback. This study addressed these issues.

In the current study, praise was provided along with the feedback displays, and was held constant across conditions. Praise was provided, rather than withheld, for two reasons. First, Johnson, Dickinson, and Huitema (2008) found that objective feedback did not improve performance when participants performed a similar data entry task and were paid hourly, as they were in this study. Second, not receiving praise in situations in which it is typically given (particularly from a supervisor when one’s performance is improving or good) might actually be aversive and suppress performance (Dickinson, 1989). Thus, in all three conditions, experimenters praised participants when their performance was good or when it increased.

In addition to examining the relative effects of the three feedback procedures on performance, this study also compared participant satisfaction with the feedback procedures. Of particular concern was the graphic display of the individual performance of all workers. When discussing the effectiveness of this type of feedback procedure, Camden et al. (2011) stated that it has several advantages; specifically, that it displays individual performance levels, holds employees publicly accountable, allows employees to compare their performance with that of their peers, and may introduce competition with their peers. However, as indicated earlier, because it compromises the identity of performers, even when codes are used, it could subject employees to aversive social contingencies and, in addition, generate detrimental forms of competition (Buskist & Morgan, 1988).
Evaluation of intervention procedures should not be based solely on the extent to which they improve performance, but also whether alternatives exist that are less intrusive and aversive. The importance of the social appropriateness of interventions has long been acknowledged in the field of behavior analysis; in his seminal article, *Social validity: The case for subjective measurement*, Wolf (1978) included it as an aspect of social validity that should be assessed. Later, Mawhinney (1984), addressing the lack of such measures in OBM research, stated: “We can achieve high productivity and high satisfaction. But we can also achieve high productivity with low satisfaction. Unless we measure dissatisfaction we cannot hope to achieve our equally worthy objectives of high productivity and high work satisfaction” (p. 23).
METHOD

Participants

Participants were 53 college students recruited from undergraduate psychology classes at a large public midwestern university. Before recruitment, Western Michigan University's Human Subjects Institutional Review Board approved the study (see Appendix A). Participants were recruited by in-class recruitment (see Appendix B for the script) and by posting to a recruitment board in the psychology advising office (see Appendix C). A questionnaire was used to ensure that participants met the minimum qualifications for the study (see Appendix D). Potential participants were excluded from the study if (a) they had previously participated in other performance management studies conducted in Dr. Dickinson’s lab, (b) they had taken either PSY 3440 or PSY 4440, (c) they did not play one of five computer games that were used as off-task activities at least one hour per month, or (d) if they were not available for one 30-minute session per week for 5 weeks during the spring 2012 semester.

There were initially 60 participants recruited for the study. Three were screened out based on the eligibility criteria outlined above, one participant was removed from the study by the primary researcher, and three participants withdrew during the study. The primary researcher found it necessary to remove one participant from the study after the first experimental session because she was executing the experimental task incorrectly despite training. Of the three participants who withdrew from the study, one left after the first session because he got a job and his schedule became too busy, the other two participants withdrew after 3 weeks with no explanation. The primary researcher did attempt to contact these two participants numerous times via phone and email.

Of the remaining 53 participants, 70% were female (n=37) and 30% were male
Participants ranged in age from 18 years to 44 years, with the majority (85%; n=45) falling between the ages of 18 and 21. Only those students who signed an informed consent (see Appendices E and F) were included in the study. All participants were paid $4.50 per session and received the pay during the debriefing session.

**Setting**

The study was conducted in an on-campus research laboratory, room 2532 Wood Hall. The laboratory room contained three work stations that were sectioned off by wall dividers. Each work station had a computer, keyboard, mouse, and gel palm rest. Participants also had a height-adjustable chair. Additional rooms (2510 and 2512 Wood Hall) were used to greet participants and privately deliver their graphic feedback before experimental sessions and at the end of experimental sessions to confirm their next scheduled session.

**Apparatus**

The experimental task consisted of a medical transcription data entry task, a task designed to simulate the job of a medical data entry clerk. The computer program provided participants with data corresponding to “patients.” Participants had to first look for the “Patient ID number” and type it into the correct location (the blank “PATIENT ID” box). Then, they had to identify whether the patient was male or female, and based on the ranges provided for that respective gender, indicate whether the patient’s data were “within range” or “outside of range” by clicking the appropriate button. Lastly, when participants were satisfied with their responses, they clicked the “submit” button to close the current patient’s record and generate the next record. Instructions were provided to
participants at the beginning of each session. A screenshot of the computer screen is provided in Appendix G.

Additionally, each computer had 5 computer games available for play at any time: Solitaire, Bejeweled, Mahjong, Text Twist, and Jewel Quest. These particular computer games were selected based on survey results from three introductory psychology classes and one child psychology class at Western Michigan University in the 2010 spring semester (N=348 students). Students were asked to pick up to 5 games they played most frequently from a list of the 20 most downloaded games on a popular computer game site, shockwave.com. The 5 most popular games, listed above, were chosen as off-task activities. Job aids with instructions on how to play each game were provided at each workstation.

**Dependent Variables**

The primary dependent variable was the number of correctly completed patient records. Other variables may have affected the primary dependent variable and thus were measured as secondary dependent variables: (1) time on-task, i.e., the average number of minutes spent performing the experimental task in each session, (2) accuracy, i.e., the average percentage of patient records completed correctly per session, and (3) data entry rate, i.e., the average number of patient records completed per minute per session when they were on-task.

The computer program automatically recorded the number of correct and incorrect patient record entries and data entry rate. Time-off-task was defined as pauses in responding longer than 30 seconds. The total number of seconds off-task was subtracted from the total session time to obtain time-on-task. Although the computer
The program was designed to measure and calculate time-on-task and rate automatically, the experimenter discovered that it was not recording time-on-task data accurately during the fourth week. The discrepancy in time-on-task data subsequently affected the calculations for the rate measure. The program was revised during the fourth week and automatically recorded these data during the fifth week of sessions. The primary researcher calculated time-on-task and rate by hand for the first four sessions, using the data file generated by the program (see the details below).

After a participant left the session, the experimenter copied all the data from the computer to a password protected flash drive to ensure prevention of data loss. At the end of the study, the primary researcher calculated the average percentage of data entry tasks completed correctly per session, the average time spent on-task per session, and the average rate per session.

The computer recorded each input for each record and the time of each input for each participant. The primary researcher looked at the details of each record to determine the inputs that had “time spent” listed as longer than 30 seconds. These seconds were then added up and subtracted from the total session time of 1800 seconds (30 minutes) to get the time on task for each participant for weeks 1 through 4. In order to calculate the rate measure for the first four sessions, the primary researcher first converted the time-on-task from seconds to minutes, and then took the number of correctly completed patient records and divided it by the time-on-task.

After their last session, participants were asked to fill out a questionnaire designed to assess their satisfaction and stress levels with the relevant feedback procedure. Four of the questions were the same for all three groups. The ratings for these items were
statistically compared. An additional two items were asked on the questionnaires for the two social comparison feedback groups, and the ratings for these items were statistically compared for these two groups. The experimenter also asked participants additional questions to obtain their opinions about the three feedback procedures. The responses to these items were analyzed by feedback procedure. The questionnaires can be found in Appendix H and the interview questions in Appendix I.

**Independent Variable**

The independent variable was the type of graphic performance feedback. There were three conditions: Individual feedback (IF), social comparison feedback in which individual performance was compared to average group performance (SCF-GA), and social comparison feedback in which individual performance was displayed for each individual (SCF-IP).

**Individual feedback.** Participants in this condition received individual feedback at the beginning of each session. The graph displayed the number of patient records completed correctly from the previous session(s) in a line graph. Participants were praised at the beginning of each session if (a) their performance increased from the previous session, or (b) their performance was higher than the group average for the respective week (though participants in this condition were never aware that a group average was calculated). A sample feedback graph is in Appendix J. The instructional script that was read to participants is in Appendix K.

**Social comparison feedback – group average.** Participants in this condition received graphic feedback at the beginning of each session that displayed the number of patient records completed correctly by the participant and the average number completed
correctly by all participants for the previous sessions. The group average was based on the performance of the other participants in this condition. Participants were praised at the beginning of each session if (a) their performance increased from the previous session, or (b) their performance was higher than the group average for the respective week. A sample feedback graph is in Appendix L. The instructional script that was read to participants is in Appendix M.

**Social comparison feedback – individual performance.** Participants in this condition received graphic feedback at the beginning of each session that displayed the number of patient records completed correctly by the participant along with the number completed correctly by each of the other participants in this condition. The graph shown to each participant displayed his or her name along with his or her data. The names of the other participants were faked. Thus, participants were deceived to believe that their name was being shown to other participants, although it was not. This deception was adopted to maximize the perceived potential social contingencies. Participants were praised at the beginning of each session if (a) their performance increased from the previous session, or (b) their performance was higher than the group average for the respective week (though participants in this condition were never aware that a group average was calculated). A sample feedback graph is in Appendix N. The instructional script that was read to participants is in Appendix O.

**Experimental Design**

The experimental design was a between group with repeated measures design. Participants were randomly assigned to one of the three groups. Each group contained between 16 and 19 participants.
Statistical Analysis

The experimental conditions during the first session were the same for all three groups because participants did not receive feedback until the beginning of their second session. Performance during the first session was used as a covariate to control for differences in keyboard proficiency, and a monotone ANCOVA was used to determine whether participants in the three groups performed differently. Only data from the last four sessions were included in this analysis. A monotone ANCOVA was used because there was reason to believe that the groups would be ordered, (i.e., IF<SCF-GA<SCF-IP) and therefore, the statistical test chosen offered the highest power and the most information about the data. For an experiment set up like the current study, “The monotone test is much more specific because we can conclude that an increase on the independent variable is associated with an increase on the dependent variable” (Huitema, 2011, p. 344).

Pearson product moment correlations were used to determine the strength of the relationship between the average number of correctly completed patient records and the three secondary dependent variables: time-on-task, accuracy, and data entry rate. Additionally, ANOVAs were conducted to determine if participants answered the questionnaire items differently.

Experimental Procedures

Random assignment. Participants were randomly assigned to groups before their introductory session so that they could be given the appropriate informed consent form. There were two different informed consent forms: one for the individual feedback (IF) and social comparison feedback – group average (SCF-GA) groups (Appendix E) and
one for the social comparison feedback – individual performance (SCF-IP) group (Appendix F). There was a different form for the SCF-IP group because these participants were led to believe that their names would be shown to other participants. However, this was not the case for participants in the other two groups. If participants in these two groups were led to believe that their names were being shown to other participants, it could have biased the results.

If prospective participants signed the consent form and were eligible to participate, they were permanently assigned to the group and were then assigned a participant number. If prospective participants did not agree or were not eligible to participate then the respective participant group assignment and participant number were reserved for the next eligible participant. The experimenter used Microsoft Excel for random assignment using the procedure described by Shadish, Cook, and Campbell (2002).

**Introductory session.** The script used for informed consent is in Appendix P. If consent was obtained, the experimenter asked potential participants to complete the eligibility questionnaire and then ensured that the participant was eligible to participate based on the four criteria described in the Participants section. If participants met the eligibility requirements, the experimenter evaluated their ability to classify three digit decimals into ranges, as required by the experimental task, using the materials in Appendix Q. The criterion for successful completion was correctly classifying 9 out of 10 examples. If participants did not meet this criterion on their first attempt, the experimenter explained why they missed the items, and repeated the evaluation with a second set of examples. A third set of examples was developed in case participants did
not meet the criterion on their second attempt; however, this set of examples was not needed. Only two participants were not able to complete the decimal classification successfully on their first attempt; they were misreading the instructions and once the instructions were explained again, they both successfully completed the task. Following successful completion of the decimal task, participants were given 10 minutes to practice the experimental task, and were then scheduled for experimental sessions.

**Experimental sessions.** Participants attended one experimental session each week for five weeks. Participants met with the experimenter or a research assistant in either 2510 or 2512 Wood Hall. The script for the first session for all participants is provided in Appendix R. The experimenter asked the participants to leave all of their belongings in that room and then gave them their feedback graph. The experimenter gave participants a few minutes to look over the graph and then escorted them to a cubicle in Wood Hall, room 2532, where the experimental sessions took place.

The computer program ended the session automatically after 30 minutes and then the experimenter confirmed the participant’s next scheduled session.

**Debriefing session.** After participants completed their final experimental session, they were scheduled for a debriefing session. During this session, the experimenter gave participants their final feedback graph. The experimenter asked participants to complete the satisfaction/stress survey and answer the interview questions. Following that, the experimenter debriefed and paid participants, giving them the receipt in Appendix S. The debriefing scripts are provided in Appendix T.
**Integrity of the Independent Variable**

All graphic feedback sessions were scripted and the experimenter read the relevant script for each condition at the beginning of sessions. The script included instructions for providing feedback to participants and how to handle participant questions regarding the graphic feedback in order to minimize any potential confounds regarding unintentional verbal feedback.
RESULTS

Primary Analyses

The main dependent variable was the number of correctly completed patient records. Table 1 displays the raw means and standard deviations for the average number of correctly completed patient records during experimental sessions for all three groups. Table 2 displays the adjusted means for the average number of correctly completed patient records during experimental sessions for all three groups.

Table 1

<table>
<thead>
<tr>
<th>Group/Type of Feedback</th>
<th>IF</th>
<th>SCF-GA</th>
<th>SCF-IP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Week One</td>
<td>160.56</td>
<td>45.30</td>
<td>166.68</td>
</tr>
<tr>
<td>Week Two</td>
<td>176.11</td>
<td>54.98</td>
<td>197.42</td>
</tr>
<tr>
<td>Week Three</td>
<td>174.24</td>
<td>57.08</td>
<td>202.47</td>
</tr>
<tr>
<td>Week Four</td>
<td>177.94</td>
<td>70.30</td>
<td>217.42</td>
</tr>
<tr>
<td>Week Five</td>
<td>183.06</td>
<td>66.66</td>
<td>201.47</td>
</tr>
<tr>
<td>Overall</td>
<td>174.32</td>
<td>58.86</td>
<td>197.03</td>
</tr>
</tbody>
</table>

To determine whether the average number of correctly completed patient records differed for the three feedback groups, a monotone ANCOVA analysis was conducted using the first session data as a covariate to control for differences in keyboard proficiency. Table 3 shows the source table for the results. The first partial regression
coefficient of 0.2243 and \( p \)-value of 0.030 indicate that the results are statistically significant and the null hypothesis of \( H_0: \theta_1 = \theta_2 = \theta_3 \) is rejected. That is, the evidence for an increasing relationship between the independent variable (type of feedback, i.e., IF < SCF-GA < SCF-IP) and the population averages on the dependent variable (number of correctly completed patient records) is convincing.

Table 2

Adjusted Means for Number of Correctly Completed Patient Records

<table>
<thead>
<tr>
<th>Group/Type of Feedback</th>
<th>IF</th>
<th>SCF-GA</th>
<th>SCF-IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mean</td>
<td>178.24</td>
<td>204.48</td>
<td>209.83</td>
</tr>
</tbody>
</table>

Table 3

Source Table for Analysis of Covariance

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Coef</th>
<th>SE Coaf</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.681</td>
<td>4.012</td>
<td>0.42</td>
<td>0.677</td>
</tr>
<tr>
<td>G Rank</td>
<td>0.2243</td>
<td>0.1005</td>
<td>2.23</td>
<td>0.030</td>
</tr>
<tr>
<td>X Rank</td>
<td>0.71341</td>
<td>0.09474</td>
<td>7.53</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Secondary Analyses

The number of correctly completed patient records could have been affected by three variables: (1) time on-task, i.e., the average number of minutes spent performing the experimental task in each session, (2) accuracy, i.e., the average percentage of patient records completed correctly per session, and (3) data entry rate, i.e., the average number
of patient records completed divided by time on task. Table 4 displays the means and standard deviations for these variables for all three experimental groups.

Table 4

Means and Standard Deviations for Time on Task, Accuracy, and Rate

<table>
<thead>
<tr>
<th>Feedback Group</th>
<th>Time on Task</th>
<th>Accuracy</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF</td>
<td>27.51</td>
<td>98.00</td>
<td>6.13</td>
</tr>
<tr>
<td>SCF-GA</td>
<td>29.25</td>
<td>97.89</td>
<td>6.72</td>
</tr>
<tr>
<td>SCF-IP</td>
<td>28.78</td>
<td>96.60</td>
<td>6.96</td>
</tr>
</tbody>
</table>

Table 5 displays the Pearson product-moment correlations between the number of correctly completed patient records and these variables. Three of the six correlations were statistically significant at the .001 level.

Table 5

Correlations Between Number of Correctly Completed Patient Records, Time on Task, Accuracy, and Rate

<table>
<thead>
<tr>
<th></th>
<th>Time on Task</th>
<th>Accuracy</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctly Completed Patient Records</td>
<td>.647*</td>
<td>.273</td>
<td>.968*</td>
</tr>
<tr>
<td>Time on Task</td>
<td>.200</td>
<td>.441*</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td></td>
<td>.269</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.001
Effects on High, Middle, and Low Performers

A post hoc change score analysis was conducted based on performance during the first and last experimental session. Performers were ranked based on their first session performance into high (top 25%, n=13), middle (middle 50%, n=27), and low (bottom 25%, n=13) performers. A two-factor ANOVA was run on the change scores, using group classification (IF, SCF-GA, and SCF-IP) and performance level as factors. Additionally, a Tukey HSD multiple comparison test was run in order to determine any differences between groups based on performance level. A significant effect was found for performance level, and a significant difference was found between high, middle, and low performers ($p < .001$ for all comparisons). High performers improved significantly more than middle performers, and middle performers improved significantly more than low performers, regardless of feedback group. Figure 1 displays the estimated mean change scores by group and performance level. As can be seen, low performers actually decreased their performance.

Figure 1. Estimated mean change scores by group and performance level.
Preference, Satisfaction, and Stress

Table 6 displays the means and standard deviations for the questionnaire items for all groups. ANOVA analyses were run on each questionnaire item in order to determine if there were any differences in how group members responded to the questionnaire items. There were no statistically significant differences found for any questions.

In addition to questionnaire items, participants in all three groups were asked open-ended questions. When asked: “Which of three graphs do you think is the most useful to help you understand your performance” after being shown the three graphs, the majority of participants in the SCF-GA and SCF-IP groups chose the graph that they had previously been exposed to (68%, n=13 and 72%, n=13; respectively). In the IF group, 25% (n=4) chose the IF graph and 63% (n=10) chose the SCF-GA graph. The majority of participants in all groups (80%, n=43) reported that they felt they changed their performance based on the feedback given. Only 1 participant (n=54 total) reported that he or she would have changed his or her performance if he or she had not received feedback; the remaining participants reported that they would not have changed their performance without the feedback. Responses to the last item: “Do you think that any of these graphs are better or worse than others,” had no discernible trends. Answers to all open-ended responses can be found in Appendix U.
Table 6
Means and Standard Deviations for Questionnaire Items (1=low and 5=high)

<table>
<thead>
<tr>
<th>Group/Type of Feedback</th>
<th>IF</th>
<th>SCF-GA</th>
<th>SCF-IP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>I liked receiving feedback about my performance.</td>
<td>4.38</td>
<td>0.50</td>
<td>4.16</td>
</tr>
<tr>
<td>I became more stressed or anxious when I received feedback about my performance.</td>
<td>2.19</td>
<td>0.91</td>
<td>2.47</td>
</tr>
<tr>
<td>I tried to alter my performance based on the average of the group. SCF-GA</td>
<td>--</td>
<td>--</td>
<td>3.47</td>
</tr>
<tr>
<td>I tried to alter my performance based on the performance of my other group members. SCF-IP</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>I was trying to beat my own performance every session.</td>
<td>4.06</td>
<td>1.00</td>
<td>3.68</td>
</tr>
<tr>
<td>I found the graph useful to tell me about my performance.</td>
<td>4.25</td>
<td>0.93</td>
<td>4.16</td>
</tr>
<tr>
<td>I was uncomfortable having my performance compared to the group’s SCF-GA</td>
<td>--</td>
<td>--</td>
<td>1.79</td>
</tr>
<tr>
<td>I was uncomfortable having other people in my group see my performance. SCF-IP</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
DISCUSSION

The primary purpose of this study was to compare three different types of graphic feedback displays; those that depicted (a) individual feedback, (b) social comparison feedback – group average, and (c) social comparison feedback – individual performance. A $p$-value of 0.030 was found after a monotone ANCOVA was conducted, meaning that there was a statistically significant difference between the performances of each group in the following ranked order: IF < SCF-GA < SCF-IP. To the author’s knowledge, this was the first study to compare the relative effects of these three feedback procedures.

All of the feedback procedures increased performance. Performers in the IF, SCF-GA and SCF-IP groups completed an average of 22.5, 34.8, and 50.72 more patient records, respectively, during their last session than their first. These results are consistent with previous studies that isolated the effects of graphic displays of individual feedback (Wilk & Redmon, 1998), individual and group feedback (Goltz et al., 1989), and the individual performance of all workers (Anderson, Crowell, Hantula, & Siroky, 1988).

The current results extend those reported by Emmert (1978), Goltz et al. (1989), and Ludwig et al. (2010). These researchers found that graphic individual feedback enhanced the effects of graphic group feedback. In the current study, graphic individual and group feedback produced higher levels of performance than individual feedback. Again, to the author’s knowledge, this was the first study to make that comparison. Taken together, the results of these studies suggest that the combination of individual and group feedback is more effective than either alone.

Interestingly, social comparison feedback did not affect high, middle, and low performers differently than individual feedback. The change score analysis indicated that, regardless of feedback group, high performers increased their performance significantly
more than middle performers and middle performers increased their performance
significantly more than low performers. Low performers actually decreased their
performance in all three groups. The experimental procedure relating to praise may have
contributed to this. The performance of participants was praised only if it was higher than
their performance in their preceding session or if it was higher than their group’s average
performance. When performance decreased or was below average, experimenters
neutrally told participants what their performance was; they did not criticize the
performance or suggest ways participants could improve their performance. Thus, the
performance of these participants was neither praised nor criticized (either explicitly or
implicitly by suggestions of how to improve). If participants had developed rules
regarding the potential social consequences for their performance, the absence of either
praise or criticism could well have resulted in a new rule, i.e., “There are no social
consequences for my performance,” and affected their performance accordingly.

Only rarely have OBM practitioners and researchers examined whether high,
middle, and low performers responded differently to their interventions even when
groups have been the unit of analysis and there have been enough participants to conduct
this type of analysis reliably. Although there are results to the contrary (Anderson,
Crowell, Sponsel et al., 1982), Anderson, Crowell, Sucec, Gilligan, and Wikoff (1982)
found results that are consistent with the current ones: high performing real estate agents
improved their performance more than middle performers who improved their
performance more than low performers. The performance patterns of the low performers
differed significantly from the performance patterns of the other two groups: their
performance decreased after the intervention was introduced and by the end of the
intervention phase was only slightly above baseline level. As argued by Crowell andAnderson (1982) there are at least two reasons why, in organizations, the performance of intact groups is more often than not the appropriate unit of analysis. First, generally, whatever procedures are implemented must be implemented for all of the employees in the relevant unit. Second, organizations are concerned about the overall effects of interventions; that is, whether significant business outcomes are achieved by the unit. Thus, the primary results of this study are more important than the fact that performance level influenced the way participants responded to the feedback procedures. Nonetheless, these results, together with those reported by Anderson, Crowell, Sucec, et al. (1982), are a reminder that an organization’s total performance system should focus on selection as well as performance management. If low performers are hired, more intensive performance management procedures are likely to be required in order to improve their performance in contrast to high and middle performers.

With respect to the secondary dependent variables, the relationship between the number of correctly completed patient records and accuracy was non-significant. Accuracy was high for all performers, regardless of group, accounting for this finding. A strong relationship was seen between the number of correctly completed patient records and the rate, and a moderate relationship was seen between the number of correctly completed patient records and time on task. These results indicate that the number of correctly completed patient records was influenced by both rate and time on task. This is consistent with results reported by McGee, Dickinson, Huitema, and Culig (2006) and Johnson (2005). Thus, it appears that individuals increase their performance on this type of data entry task by spending more time on task and increasing their speed.
In order to examine satisfaction among participants in each group, ANOVA analyses were conducted on each questionnaire item. There were no statistically significant differences found between the groups. These results differed from what was expected in that individuals did not perceive the SCF-IP to be more aversive than the other two feedback procedures.

Collectively, these results imply that organizations would gain maximum performance increases by providing graphic feedback that displays the individual performances of each individual. Results of this study also showed that under these particular experimental conditions, participants did not find the SCF-IP any more aversive than IF or SCF-GA.

**Participant Performance**

One interpretation of the performance results is that the ordered increases in performance were due to additional information being provided to the respective experimental groups. That is, individuals in the individual feedback group received information about their performance only, individuals in the social comparison feedback group received information about their performance and about the average group performance, and individuals in the social comparison feedback group received information about the individual performance of each group member. Thus, the order of significance (IF < SCF-GA < SCF-IP) corresponded to the level of information provided (least < moderate < most).

A behavioral interpretation of these results is that the performance data of others served as discriminative stimuli for the performers, even though the groups were non-co-acting. An individual’s history of reinforcement deems that different situations provide
different contingencies, some reinforcing and others punishing. McGinnies (1970) stated that, “most persons learn the appropriate discriminations; in one sense, we can say that they assume the “role” that is most likely to be reinforced in a given set of circumstances” (p. 110). The presence of others or the performance data of others can discriminate changes in consequences specific to one person, or can create generalizable discriminations to consequences that occur in the presence of people in general (Buskist & Morgan, 1988; Guerin, 1994). Even though individuals in the SCF-GA and SCF-IP groups worked alone they were still aware that they were in a group and therefore may have performed at a higher level than individuals in the IF group because there were more discriminative stimuli to designate “appropriate behavior” and, thus, based on historical contingencies, whether social consequences for their own performance were likely to be positive or negative.

**Participant Satisfaction**

SCF-IP has consistently improved performance in numerous studies, including the current one, indicating that it is a powerful intervention. However, the competition and social facilitation/loafing literature discussed earlier suggests that individuals may find this type of feedback to be more aversive than IF or SCF-GA. That was not the case in the current study; when ANOVAs were conducted on ratings of questionnaire items, there were no statistically significant differences between the three groups. Also, responses to the open-ended questions at the end of the study (after all three graphs were shown and explained to participants) revealed that, across all three groups, more participants responded positively than negatively to the SCF-IP graph. As examples, only four out of the 54 participants reported that the SCF-IP graph would (or did) make them
uncomfortable, three explicitly reported that they liked the SCF-IP graph because of the competitive nature, and three stated that they liked the SCF-IP graph better implying that it was because of the competitive nature. Additionally, only one participant reported that the SCF-GA graph made him or her feel more stressed than the other two graphs.

When participants were asked which of the graphs was most helpful with respect to understanding their performance, interesting differences occurred based on initial group placement. That is, participants responded differently based on which graph they had been previously exposed to. Participants in the IF and SCF-GA groups chose the SCF-GA graph most often (IF, n = 10 of 16; SCF-GA, n = 13 of 19). Participants in the SCF-IP group, however, chose the SCF-IP graph more frequently than the other two (n = 13 of 18). The majority of participants in the IF and SCF-GA groups stated that the reason they did not like the SCF-IP group was because of the “clutter” and general “confusion” of the graph, however, not because it displayed individual participant names. Different results, thus, may well be obtained if (a) the performances of fewer individuals are displayed on SCF-IP graphs and (b) individuals are actually exposed to the graph. Arguably, given the qualitative nature of these data, they do suggest that individuals perceive SCF-GA to be more useful than IF and they do not perceive the SCF-IP to be aversive due to names being displayed.

Even though there were no statistically significant differences among the three groups with respect to satisfaction and the qualitative data suggest that SCF-IP was not aversive, there are reasons why these results may be limited. A few possibilities are outlined below, although all are related.
1) The groups were non-co-acting: Even though the SCF-IP graph contained names, the names were fabricated and participants could not identify or interact with one another. If participants were able to interact with one another, social contingencies, both positive and negative, may have been more salient, as discussed by Buskist and Morgan (1988).

2) There were no pre-existing relationships among individuals: Previous research has found that pre-existing relationships among participants can affect their decision to compete (Swingle & Gillis, 1968). For example, if an existing work group has a good relationship it may be aversive for them to be forced to compete with one another.

3) Consequences: It is possible that individuals would have found the SCF-IP group more aversive had the potential consequences been more powerful (i.e., if performance in comparison to others would affect pay raises, choice job assignments, opportunities for advancement, or potential loss of a job). Participants in the current study may have perceived the SCF-IP to be minimally competitive, as defined by Buskist and Morgan (1988), given that valued rewards were not differentially distributed based on performance.

4) The work environment and company culture: Some organizational cultures reinforce a competitive environment, while others punish it. McGinnies (1970) explained that individuals will act in accordance with the “role” that has been reinforced or punished in the past. Thus, individual histories and organizational contingencies will determine an individual’s level of comfort and/or tolerance with a competitive environment.
In this study, the SCF-IP resulted in the highest performance and was not perceived to be any more aversive than the other two types of feedback. However, when implementing this type of feedback individuals should take the variables discussed above into account.

**Strengths of the Study**

The current study was the first to directly compare these three different types of graphic feedback displays, allowing for systematic comparisons wherein specific characteristics were held constant:

1) Feedback was used in isolation without other interventions (i.e., goal setting);

2) Only one feedback dimension was used (e.g., graphic);

3) With the exception of praise, which was controlled across conditions, only one type of feedback was provided.

The results of the current study will allow researchers and practitioners to make more informed decisions about what feedback procedures to use.

Additionally, the current study experimentally evaluated the effects of IF and SCF-GA, again the first to do so to the author’s knowledge. Lastly, the results of the change score analysis suggests that performance management interventions may affect high, middle, and low performers differently; this type of analysis has not received much attention in the OBM literature.

**Weaknesses of the Study**

The study was conducted in an analog setting, which was a strength in terms of experimental control, but was also a limitation in that the results might have differed if the study had been conducted with actual employees. Crowell (2012) pointed out that
organizations typically want quick interventions, sometimes at the sacrifice of proven and effective interventions, while good science in general values proven and effective interventions over quick interventions. The current study sought to contribute to the scientific knowledgebase by providing insight that could potentially make graphic feedback more effective.

The current study had groups that were non-co-acting and therefore probably unrealistic. That is, it is very unlikely that individuals in a work group/organizational setting would not know (or have existing relationships) with one another. Previous research indicates that this factor is a large influencer in how individuals behave in competitive situations.

**Future Research**

Future researchers should replicate the current study in a business environment to look at generalizability from an analog setting to the larger business community. These types of feedback are currently being used in the business community and it is therefore important that research provides useful guidance to the business community with respect to how to best design feedback interventions. As an example, Sears Holdings Corporation uses a system called “Game On” which is a web-based system that allows employees to receive real-time feedback based on critical performance metrics. Examples of the information included in “Game On” are: Primary metrics that are color coded so individuals know whether or not they are on track or falling behind, tips on how to improve performance, comparisons of individual performance to the performance of other team members, and comparison of individual performance to department and national averages. Sears has experienced favorable responses from their employees; other
companies are sure to follow suit when programs like this become publicized (K. J. Munson, personal communication, March 2012). Already, start-up companies that offer gamification are emerging and offering similar programs to organizations (USA Today, 2012).

Future research should also continue to focus on systematic comparisons of different types of feedback. As indicated previously, feedback is the most widely used intervention in OBM, but is an overarching term that could benefit from experimental analysis. Results of structural reviews of feedback applications (Alvero et al., 2001; Balcazar et al., 1985-86) have differed from experimental analyses (Goltz et al., 1989), underscoring the importance of experimental analyses.

The results of the current study indicated that there was a significant difference between these three different types of graphic feedback. Even if there are differences between research conducted in an analog setting and an actual workplace, these potential lines of research can inform practitioners of the most effective and least intrusive approaches to take based on a company’s department, culture, etc. By continuing to build on the results of the current study, researchers and practitioners will be guided toward the most effective uses of feedback in organizations, and will have alternatives that can be tailored to the respective organizational culture. This will allow researchers and practitioners to make informed decisions based on data. The end result: Practitioners will be able to provide better service to their consumers.
REFERENCES


to sell more. *Journal of Organizational Behavior Management, 4*(1-2), 67-95. doi: 10.1300/J075v04n01_03


Appendix A

HSIRB Approval Letter
Date: February 8, 2012

To: Alyce Dickinson, Principal Investigator
    Sarah VanStelle, Student Investigator for thesis

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 12-02-23

This letter will serve as confirmation that your research project titled “Performance on a Data Entry Task When Participants Receive Three Different Types of Graphic Feedback” has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination:   February 8, 2013
Appendix B

Participant Recruitment Script
Participant Recruitment Script

To be read aloud by the student investigator at undergraduate classes:

"Hi, my name is Sarah VanStelle. I am a graduate student here in the Psychology Department and I am getting ready to start my doctoral dissertation. I am visiting your class today to recruit participants for my study. To be a participant, you must be available for one, 30 minute session per week for 5 weeks during the Spring 2012 semester. Additionally, you cannot have previously participated in other performance management studies conducted here at Western Michigan University or taken either PSY 3440 or PSY 4440.

Participation will involve a medical transcription data entry task in which you will be asked to enter data on a computer for 5 sessions. Sessions will last 30 minutes and you will be required to attend one session per week, for 5 weeks. You will be able to take breaks during the session whenever you want. If you choose to participate in my study, you will receive monetary compensation that will equal $4.50 per session.

Your participation is completely voluntary and you may withdraw at any time. If you do withdraw, you will be paid the money you have earned up to that point. Your willingness to participate in the study or your withdrawal from the study will not affect your grade in any course and your participation will remain confidential.

If you are interested in learning more about my study, please list your contact information on the individual participant recruitment slips, which I will collect in a few minutes. You can also contact me at sarah.vanstelle@wmich.edu or (269) 387-4439. Please remember that you must be available for 5 weeks during the Spring 2012 semester. I will contact you within the week to talk more about your potential participation. Thank you for your time"
Appendix C

Participant Recruitment Flyer
Research Participants Needed!!

I am looking for individuals to participate in a study designed to examine productivity levels on a medical data entry task across time when performers are given performance feedback. Participation will involve a computerized medical transcription data entry task.

To be eligible for participation in this study, you must be available for one, 30 minute session (in Wood Hall) per week for 5 weeks during the Spring 2012 semester. Additionally, you cannot have previously participated in other performance management studies conducted here at Western Michigan University or taken either PSY 3440 or PSY 4440.

Potential participants will be required to attend an introductory session prior to the beginning of the study.

If you choose to participate in this study, you will receive monetary compensation that will equal $4.50 per session.

If you are interested in learning more about this study, please contact Sarah VanStelle at sarah.vanstelle@wmich.edu or (269) 387-4439. Be sure to provide your name, e-mail address or telephone number, and the times you can be reached. Please remember that you must be available for 5 weeks during the Spring 2012 semester.

All information is confidential! Thank you!!

For more information contact Sarah VanStelle

E-mail: Sarah.vanstelle@wmich.edu
or
Phone: (269) 387-4439
Appendix D

Study Inclusion Questionnaire
Participant Number: _____
Date: __________

1. Please check one:
   Gender: Male: _____   Female: _____

2. What is your age? _____

3. Have you ever participated in a study in Dr. Dickinson’s lab before?
   Yes: _____    No: _____

4. Have you taken, or are currently taking, either of the following classes?
   PSY 3440, Organizational Psychology    Yes: _____    No: _____
   PSY 4440, Industrial/Organizational Psychology    Yes: _____    No: _____

5. Do you play the following computer games? (circle one answer for each game)
   Solitaire       Yes       No
   Bejeweled       Yes       No
   Jewel Quest     Yes       No
   Mahjong         Yes       No
   Text Twist      Yes       No

6. On average, how many hours per month do you play computer games? (circle one):
   Less than 1   2   3   4   5   6   7   8   9   10+ hours

7. Do you know anyone else that has signed up to participate in the study? If so, please list their names below:
Appendix E

Informed Consent Form – IF and SCF-GA
Western Michigan University  
Department of Psychology

**Principal Investigator:** Alyce M. Dickinson, Ph.D.  
**Student Investigator:** Sarah E. VanStelle, M.A.  
**Title of Study:** Performance on a Medical Transcription Data Entry Task When Participants Receive Performance Feedback

You have been asked to participate in a research project titled “Performance on a Medical Transcription Data Entry Task When Participants Receive Performance Feedback.” This project will serve as Sarah VanStelle’s dissertation project under the supervision of Alyce Dickinson, Ph.D.

This informed consent document will explain the purpose of this research project and will cover information related to the project, including expected time commitments, research procedures to be used in the study, and any risks or benefits associated with participating in this research project.

**What are we trying to find out in this study?**  
The purpose of this study is to examine productivity levels on a medical data entry task across time when performers are given performance feedback.

**Who can participate in this study?**  
Four inclusionary criteria will be used. First, you must not have participated in any other performance management research projects conducted in Dr. Dickinson’s lab. Second, you must play one of five computer games for at least one hour per month. Third, you must not have taken, or currently be enrolled in PSY 3440 or PSY 4440. Last, you must be available for one 30-minute session per week for five weeks during the Spring 2012 semester.

**Where will the study take place?**  
The study will be conducted in room 2532, Wood Hall.

**What is the time commitment for participating in this study?**  
You must be available for one 30-minute session per week for 5 weeks during the Spring 2012 semester for a total time commitment of approximately 3 hours.

**What will you be asked to do if you choose to participate in this study?**  
You will be asked to perform a computer-based medical transcription data entry task, a task designed to simulate the job of a medical data entry clerk. The computer program will provide you with data corresponding to patients. You will first type the patient’s ID number into a box labeled “PATIENT ID,” and then, based on the information provided by the program, indicate whether the medical data for that patient is inside or outside the
normal range by clicking on the appropriate button. After you click the “Submit” button, information about another patient will be presented. Also, after your last session, you will be asked to answer questions about your experience during the study. Lastly, you will be asked not to talk to anyone about the features of this study.

**What information is being measured during this study?**
The computer will automatically take measures of your performance on the medical transcription data entry task. Also, at the end of the study you will be asked to indicate your satisfaction with the procedures and how much stress you felt performing the task.

**What are the risks of participating in this study and how will these risks be minimized?**
The nature of this computer-based task is one that requires little physical effort, and should not expose you to risks greater than those you experience in your everyday activities. During sessions you may become tired or experience minor physical discomfort or stress. To minimize these risks, you may take breaks whenever you like. During these breaks you may play one of several computer games or just relax.

**What are the benefits of participating in this study?**
Data from your participation may benefit the general scientific community by providing information on performance feedback and productivity. You may also learn about this research through participation in this study. This study will add to our understanding of how working conditions affect performance, satisfaction, and stress. The findings from analogue studies such as this can be applied in workplace settings.

**Are there any costs associated with participating in this study?**
Besides the time commitment of approximately 3 total hours, there are no costs associated with participating in this study.

**Is there any compensation for participating in this study?**
For each session after the introductory session, you will be compensated. You will receive $4.50 per session for a total of $22.50. You will be paid in cash during the debriefing session, after your last experimental session. If you decide to withdraw from this study, you will be paid for your performance up until the point of withdrawal.

**Who will have access to the information collected during the study?**
The principal investigator, the student investigator, and the research assistants will have access to the information collected during this study. When you begin the study, you will be assigned a code number so that your individual progress can be tracked while your identity is held strictly confidential. When the data from the study are presented or published, your data will be combined with the data from others, and only group data will be presented. You will not be identified.
What if you want to stop participating in this study?
You can choose to stop participating in this study at any time, for any reason, without penalty. The investigator can also decide to stop your participation in the study without your consent.

If you should have any questions before or during the study, you can contact the primary investigator, Dr. Alyce Dickinson at (269) 387-4473, or the student investigator at (269) 387-4439. You may also contact the Chair, Human Subjects Institutional Review Board at (269) 387-8293 or the Vice President for Research at (269) 387-8298 if questions arise throughout the course of this study.

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.

Your signature below indicates that you read the above information and agree to participate in the study.

____________________________________
Please Print Your Name

____________________________________  ______________
Participant Signature                   Date

Please keep the attached copy of this form for your records.
Appendix F

Informed Consent Form – SCF-IP
Western Michigan University
Department of Psychology

Principal Investigator: Alyce M. Dickinson, Ph.D.
Student Investigator: Sarah E. VanStelle, M.A.
Title of Study: Performance on a Medical Transcription Data Entry Task When Participants Receive Performance Feedback

You have been asked to participate in a research project titled “Performance on a Medical Transcription Data Entry Task When Participants Receive Performance Feedback.” This project will serve as Sarah VanStelle’s dissertation project under the supervision of Alyce Dickinson, Ph.D.

This informed consent document will explain the purpose of this research project and will cover information related to the project, including expected time commitments, research procedures to be used in the study, and any risks or benefits associated with participating in this research project.

What are we trying to find out in this study?
The purpose of this study is to examine productivity levels on a medical data entry task across time when performers are given performance feedback.

Who can participate in this study?
Four inclusionary criteria will be used. First, you must not have participated in any other performance management research projects conducted in Dr. Dickinson’s lab. Second, you must play one of five computer games for at least one hour per month. Third, you must not have taken, or currently be enrolled in PSY 3440 or PSY 4440. Last, you must be available for one 30-minute session per week for five weeks during the Spring 2012 semester.

Where will the study take place?
The study will be conducted in room 2532, Wood Hall.

What is the time commitment for participating in this study?
You must be available for one 30-minute session per week for 5 weeks during the Spring 2012 semester for a total time commitment of approximately 3 hours.

What will you be asked to do if you choose to participate in this study?
You will be asked to perform a computer-based medical transcription data entry task, a task designed to simulate the job of a medical data entry clerk. The computer program will provide you with data corresponding to patients. You will first type the patient’s ID number into a box labeled “PATIENT ID,” and then, based on the information provided by the program, indicate whether the medical data for that patient is inside or outside the
normal range by clicking on the appropriate button. After you click the “Submit” button, information about another patient will be presented. Also, after your last session, you will be asked to answer questions about your experience during the study. Lastly, you will be asked not to talk to anyone about the features of this study.

**What information is being measured during this study?**
The computer will automatically take measures of your performance on the medical transcription data entry task. Also, at the end of the study you will be asked to indicate your satisfaction with the procedures and how much stress you felt performing the task.

**What are the risks of participating in this study and how will these risks be minimized?**
The nature of this computer-based task is one that requires little physical effort, and should not expose you to risks greater than those you experience in your everyday activities. During sessions you may become tired or experience minor physical discomfort or stress. To minimize these risks, you may take breaks whenever you like. During these breaks you may play one of several computer games or just relax.

Additionally, your identity will be revealed to other group members. Your name will be displayed on the feedback graphs for your group along with the names of all other group members. This means that group members will be able to compare performance among one another.

**What are the benefits of participating in this study?**
Data from your participation may benefit the general scientific community by providing information on performance feedback and productivity. You may also learn about this research through participation in this study. This study will add to our understanding of how working conditions affect performance, satisfaction, and stress. The findings from analogue studies such as this can be applied in workplace settings.

**Are there any costs associated with participating in this study?**
Besides the time commitment of approximately 3 total hours, there are no costs associated with participating in this study.

**Is there any compensation for participating in this study?**
For each session after the introductory session, you will be compensated. You will receive $4.50 per session for a total of $22.50. You will be paid in cash during the debriefing session, after your last experimental session. If you decide to withdraw from this study, you will be paid for your performance up until the point of withdrawal.

**Who will have access to the information collected during the study?**
The principal investigator, the student investigator, and the research assistants will have access to the information collected during this study. When you begin the study, you will
be assigned a code number so that your individual progress can be tracked while your identity is held strictly confidential. When the data from the study are presented or published, your data will be combined with the data from others, and only group data will be presented. You will not be identified.

The only exception to confidentiality as described in the preceding paragraph is that your identity will be revealed to other group members, (as described above in the risks section).

**What if you want to stop participating in this study?**
You can choose to stop participating in this study at any time, for any reason, without penalty. The investigator can also decide to stop your participation in the study without your consent.

If you should have any questions before or during the study, you can contact the primary investigator, Dr. Alyce Dickinson at (269) 387-4473, or the student investigator at (269) 387-4439. You may also contact the Chair, Human Subjects Institutional Review Board at (269) 387-8293 or the Vice President for Research at (269) 387-8298 if questions arise throughout the course of this study.

*This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.*

**Your signature below indicates that you read the above information and agree to participate in the study.**

____________________________________

Please Print Your Name

____________________________________

Participant Signature Date

Please keep the attached copy of this form for your records.
Appendix G

Screenshot of Apparatus
Appendix H

Participant Questionnaires
**IF (Individual Feedback)**

Please rate your agreement with each statement below by circling a number next to it. Use the scale below to make your choice.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>strongly disagree</td>
<td>disagree</td>
<td>undecided</td>
<td>agree</td>
<td>strongly agree</td>
<td></td>
</tr>
</tbody>
</table>

I liked receiving feedback about my performance.  

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I became more stressed or anxious when I received feedback about my performance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I was trying to beat my own performance every session.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I found the graph useful to tell me about my performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**SCF-GA (Social Comparison Feedback – Group Average)**

*Please rate your agreement with each statement below by circling a number next to it. Use the scale below to make your choice.*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I liked receiving feedback about my performance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I became more stressed or anxious when I received feedback about my performance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I tried to alter my performance based on the average performance of the group.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I was trying to beat my own performance every session.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I found the graph useful to tell me about my performance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I was uncomfortable having my performance compared to the group’s performance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SCF-IP (Social Comparison Feedback – Individual Performance)

*Please rate your agreement with each statement below by circling a number next to it.*

*Use the scale below to make your choice.*

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I liked receiving feedback about my performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I became more stressed or anxious when I received feedback about my performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I tried to alter my performance based on the performance of my other group members.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I was trying to beat my own performance every session.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I found the graph useful to tell me about my performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I was uncomfortable having other people in my group see my performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Appendix I

Interview Questions
Exit Interview Questions

**To be read by the researcher following completion of the participant questionnaires**

“I would like you to take a look at the three graphs below and answer a few questions about them. Imagine that you had the option to choose the type of performance feedback that you received during the experiment”

**Lay out sample graphs for each of the three conditions**

1) Which of these three graphs do you think is (or would be) the most effective to help you understand your performance?

- Individual Graph
- SCF – GA
- SCF - IP

2) Do you think that any of these three graphs are better or worse than the others?

- Individual Graph
- SCF – GA
- SCF - IP

3) Why or why not?

4) Do you feel that you changed your performance based on the feedback that we gave you? Remember that you did not receive your first feedback graph until your second session.

   Yes          No

5) If so? Why?

6) Do you think that you would have tried harder than you would have if we did not provide you any feedback graphs?

   Yes          No

7) If so? Why?
Appendix J

Sample of Individual Feedback Graph
Appendix K

Individual Feedback – Instructional Script
Beginning of Session Instructions:

**Before the participant arrives, the research assistant will take out the graph of previous performance for the participant. When the participant arrives in either 2510 or 2512 Wood Hall, the research assistant will greet the participant and close the door (to ensure privacy).**

**The research assistant will read aloud:**

“Here is a graph of your performance for each session so far. This graph will get updated with your information after every session that you complete.”

**The research assistant will give the participant a moment to look at the graph, and will then praise increased performance if applicable:**

“**Great! It looks like you have improved your performance from the previous sessions!**”

**The research assistant will then read aloud:**

“**Remember that before you go to the experimental room, that you should leave all your personal items, cell phone, electronics, etc. here in this lab room, I will lock the door when we leave.**”

“**Your task for this session will be to complete a computer-based data entry task, we are looking at your level of performance throughout this study, so be sure to complete as many correct data entries as possible during the next 30 minutes. You will be compensated $4.50 for every session at the end of the study. If you feel tired and need a break, you may take a break and will not be penalized for taking the break. You can either relax or play any of the available computer games. Please work at your own pace for the next 30 minutes. It is also important that you stay at your workstation and do not talk to any of the other people present in the lab room. If you have any questions, I will be on the other side of the room. I will come back and let you know when your session is over.**”

**The research assistant will take the participant to his or her workstation in the laboratory room (2532 Wood Hall) and prompt him or her to begin their work session.**

**The research assistant will start the timer.**

End of Session:

**The research assistant will let the participant know when his or her 30 minute session is over; the research assistant will then take the participant back to either 2510 or 2512 Wood Hall and remind the participant when his or her next session is.**
Appendix L

Sample of SCF-GA Graph
Appendix M

SCF- GA – Instructional Script
Beginning of Session Instructions:

**Before the participant arrives, the research assistant will take out the graph of previous performance for the participant. When the participant arrives in either 2510 or 2512 Wood Hall, the research assistant will greet the participant and close the door (to ensure privacy).

**The research assistant will read aloud:

“Here is a graph of your performance for each session so far. This graph will get updated with your information after every session that you complete. You will also notice that there is a group average line, there are 15 total people in this group for this study and the group average line represents the average of the entire group.”

**The research assistant will be permitted to answer any questions that the participant has about the average line and can confirm or deny any of the participants assertions related to the graph (i.e., so I am much lower/higher than average right?)

**The research assistant will give the participant a moment to look at the graph and will then praise increased performance if applicable:

“Great! It looks like you have improved your performance from the previous sessions!”

**The research assistant will then read aloud:

“Remember that before you go to the experimental room, that you should leave all your personal items, cell phone, electronics, etc. here in this lab room, I will lock the door when we leave.”

“Your task for this session will be to complete a computer-based data entry task, we are looking at your level of performance throughout this study, so be sure to complete as many correct data entries as possible during the next 30 minutes. You will be compensated $4.50 for every session at the end of the study. If you feel tired and need a break, you may take a break and will not be penalized for taking the break. You can either relax or play any of the available computer games.

Please work at your own pace for the next 30 minutes. It is also important that you stay at your workstation and do not talk to any of the other people present in the lab room. If you have any questions, I will be on the other side of the room. I will come back and let you know when your session is over.”

**The research assistant will take the participant to his or her work station in the laboratory room (2532 Wood Hall) and prompt him or her to begin their work session.

**The research assistant will start the timer.
End of Session:

**The research assistant will let the participant know when his or her 30 minute session is over; the research assistant will then take the participant back to either 2510 or 2512 Wood Hall and remind the participant when his or her next session is.**
Appendix N

Sample of SCF – IP Graph
Appendix O

SCF – IP Instructional Script
Beginning of Session Instructions:

**Before the participant arrives, the research assistant will take out the graph of previous performance for the participant. When the participant arrives in either 2510 or 2512 Wood Hall, the research assistant will greet the participant and close the door (to ensure privacy).**

**The research assistant will read aloud:**

“Here is a graph of your performance for each session so far. This graph will get updated with your information after every session that you complete. Your data path is represented here (**RA should point to the participants data). You will also notice that there are other lines of data represented on the graph, there are 15 total people in this group for this study and the other data lines represent their performance.”

**The research assistant will be permitted to answer any questions that the participant has about where they fall in the data and can confirm or deny any of the participants assertions related to the graph (i.e., so I am much lower/higher than participant 2,3,4 right?)**

**The research assistant will give the participant a moment to look at the graph and will then praise increased performance if applicable:**

“Great! It looks like you have improved your performance from the previous sessions!”

**The research assistant will then read aloud:**

“Remember that before you go to the experimental room, that you should leave all your personal items, cell phone, electronics, etc. here in this lab room, I will lock the door when we leave.”

“Your task for this session will be to complete a computer-based data entry task, we are looking at your level of performance throughout this study, so be sure to complete as many correct data entries as possible during the next 30 minutes. You will be compensated $4.50 for every session at the end of the study. If you feel tired and need a break, you may take a break and will not be penalized for taking the break. You can either relax or play any of the available computer games.

Please work at your own pace for the next 30 minutes. It is also important that you stay at your workstation and do not talk to any of the other people present in the lab room. If you have any questions, I will be on the other side of the room. I will come back and let you know when your session is over.”

**The research assistant will take the participant to his or her work station in the laboratory room (2532 Wood Hall) and prompt him or her to begin their work session.**
**The research assistant will start the timer.

**End of Session:**

**The research assistant will let the participant know when his or her 30 minute session is over; the research assistant will then take the participant back to either 2510 or 2512 Wood Hall and remind the participant when his or her next session is.**
Appendix P

Informed Consent Script
The student investigator will meet with potential participants in Dr. Dickinson’s laboratory (2532 Wood Hall)

The student investigator will take out two copies of the relevant informed consent form (Appendix D or E) and will read aloud the paragraphs below to the individual privately:

“It is important that I explain the consent form to you. I would like you to follow along as I read through the form. After I finish reading, I will be happy to answer any questions that you may have. After we read through the informed consent form, we will also talk about study inclusion criteria.”

If the potential participant agrees to participate, ask the participant to sign the consent form. Then provide the participant a copy of the consent form and retain a copy for record.

If the participant does not agree to participate, thank them for their time and interest in the study and dismiss them.

**Only for those individuals who have agreed to participate**

The student investigator will explain the inclusionary criteria, and the procedures associated with each by reading the below aloud.

“As indicated in the consent form, there are some inclusionary criteria for the study. Please complete this questionnaire and after you have completed it, give it to me and I will look at your answers to determine your eligibility.” Hand participants the study inclusion questionnaire and allow them time to fill it out. When the participant has finished the questionnaire, look for the following:

If they answer “Yes” to questions #3 or #4, or if they answer that they DO NOT play computer games, the research assistant will read the following:

“I’m sorry; you do not meet one or more of the qualifications from the study inclusion questionnaire. Thank you for your time and interest in the study, hopefully you will be eligible to participate in a future study!”

If the participant meets eligibility based on the “Study Inclusion Questionnaire” the student investigator will read the following:

“Ok, great! I have one additional question for you. One of the qualifications for inclusion in this study is that you are available for one, 30-minute session every week for the next five weeks. I can assure you that session dates and times are flexible within the week. Are you available for one, 30-minute session per week for the next five weeks?”

If the participant says no, the student investigator will read the following:
“I’m sorry; you need to be available for one session per week for the next five weeks. Thank you for your time and interest in the study; hopefully you will be eligible to participate in a future study!”

If the participant says yes, the student investigator will read the following:

“Great! You have met all the criteria for eligibility in this study. I would like you to take the opportunity to practice the experimental task for about 10 minutes. This is the task that you will be doing during the sessions.”

After this practice opportunity, the researcher and the participant will schedule the next week’s sessions.
Appendix Q

Evaluation/Training for Classification of Decimals
**Script for Decimal Point Training:**

After the potential participant signs the informed consent form and completes the study inclusion questionnaire they should be tested / trained on their knowledge of reading decimal points.

A) Prior to having the potential participant practice the experimental task, please have them complete one of the worksheets below.

- If the potential participant completes the task with 9 of the 10 items correct (90%). You should proceed with the remainder of the informed consent script.

- If the participant does not get 9 of the 10 items correct, please provide constructive feedback on what they answered incorrectly. For example: The range listed is (0.065 to 0.072) and the individual answers “Within”

  1) 0.058

   *Within* Outside

   You might say something like:

   “When looking at the numbers after the decimal point, the first number is 0 which does not tell you if the number is within or outside of range as all of the numbers start with 0.0. So, you will move to the next number, 5 and that will tell you that .05 is less than .06 (the lower limit), so that means that it has to be lower than the upper limit of .07. Therefore it is outside of the range. Does this make sense?”

B) You would then talk through each of the answers that the individual missed and then ask them to complete another worksheet (choose a different one than you picked for the first step in Part A)

- If the potential participant completes the task with 9 of the 10 items correct (90%) in the second worksheet, you should proceed with the remainder of the informed consent script.

- If the participant does not get 9 of the 10 items correct, please provide constructive feedback on what they answered incorrectly as described above.

C) You would then talk through each of the answers that the individual missed the second time around and ask them to complete another
worksheet (again, choose a different worksheet than for the previous two trials (A and B))

- If the potential participant does not correctly complete 9 of the 10 items (90%) on the third worksheet, kindly dismiss them from the study per the instructional text in the informed consent script.
Worksheet Number One

For the items below: Please indicate whether each of the numbers listed is within or outside of the range (0.065 to 0.072)

1) 0.058  Within  Outside
2) 0.064  Within  Outside
3) 0.066  Within  Outside
4) 0.075  Within  Outside
5) 0.071  Within  Outside

Here is another range, please indicate whether each of the numbers listed is within or outside of the range (0.143 to 0.155)

6) 0.099  Within  Outside
7) 0.150  Within  Outside
8) 0.148  Within  Outside
9) 0.154  Within  Outside
10) 0.156  Within  Outside
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>0.058</td>
<td>Within</td>
</tr>
<tr>
<td>2)</td>
<td>0.064</td>
<td>Within</td>
</tr>
<tr>
<td>3)</td>
<td>0.066</td>
<td>Within</td>
</tr>
<tr>
<td>4)</td>
<td>0.075</td>
<td>Within</td>
</tr>
<tr>
<td>5)</td>
<td>0.071</td>
<td>Within</td>
</tr>
<tr>
<td>6)</td>
<td>0.099</td>
<td>Within</td>
</tr>
<tr>
<td>7)</td>
<td>0.150</td>
<td>Within</td>
</tr>
<tr>
<td>8)</td>
<td>0.148</td>
<td>Within</td>
</tr>
<tr>
<td>9)</td>
<td>0.154</td>
<td>Within</td>
</tr>
<tr>
<td>10)</td>
<td>0.156</td>
<td>Within</td>
</tr>
</tbody>
</table>
Worksheet Number Two

For the items below: Please indicate whether each of the numbers listed is within or outside of the range (0.321 to 0.329)

1) 0.322  Within  Outside
2) 0.320  Within  Outside
3) 0.328  Within  Outside
4) 0.319  Within  Outside
5) 0.330  Within  Outside

Here is another range, please indicate whether each of the numbers listed is within or outside of the range (0.021 to 0.033)

6) 0.045  Within  Outside
7) 0.027  Within  Outside
8) 0.022  Within  Outside
9) 0.038  Within  Outside
10) 0.032  Within  Outside
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.322</td>
<td>Within</td>
<td>Outside</td>
</tr>
<tr>
<td>2</td>
<td>0.320</td>
<td>Within</td>
<td>Outside</td>
</tr>
<tr>
<td>3</td>
<td>0.328</td>
<td>Within</td>
<td>Outside</td>
</tr>
<tr>
<td>4</td>
<td>0.319</td>
<td>Within</td>
<td>Outside</td>
</tr>
<tr>
<td>5</td>
<td>0.330</td>
<td>Within</td>
<td>Outside</td>
</tr>
<tr>
<td>6</td>
<td>0.045</td>
<td>Within</td>
<td>Outside</td>
</tr>
<tr>
<td>7</td>
<td>0.027</td>
<td>Within</td>
<td>Outside</td>
</tr>
<tr>
<td>8</td>
<td>0.022</td>
<td>Within</td>
<td>Outside</td>
</tr>
<tr>
<td>9</td>
<td>0.038</td>
<td>Within</td>
<td>Outside</td>
</tr>
<tr>
<td>10</td>
<td>0.032</td>
<td>Within</td>
<td>Outside</td>
</tr>
</tbody>
</table>
Worksheet Number Three

For the items below: Please indicate whether each of the numbers listed is within or outside of the range (0.804 to 0.808)

1) 0.809  Within  Outside
2) 0.806  Within  Outside
3) 0.810  Within  Outside
4) 0.802  Within  Outside
5) 0.807  Within  Outside

Here is another range, please indicate whether each of the numbers listed is within or outside of the range (0.089 to 0.098)

6) 0.090  Within  Outside
7) 0.092  Within  Outside
8) 0.087  Within  Outside
9) 0.099  Within  Outside
10) 0.097 Within  Outside
**ANSWER KEY - THREE**

1) 0.809  Within  Outside  
2) 0.806  Within  Outside  
3) 0.810  Within  Outside  
4) 0.802  Within  Outside  
5) 0.807  Within  Outside  
6) 0.090  Within  Outside  
7) 0.092  Within  Outside  
8) 0.087  Within  Outside  
9) 0.099  Within  Outside  
10) 0.097  Within  Outside
Appendix R

First Session Script for All Participants
First Session:

Introductory sessions will begin in 2510 or 2512 Wood Hall:

The student investigator or the research assistant will read aloud the paragraphs below at the beginning of the initial session for each participant:

“For all future sessions, we will meet in this room or the room next door. Before you go to the experimental room, you will leave all your personal items, cell phone, electronics, etc. here in this lab room. I will lock the door when we leave.”

“Your task for this session and all future sessions will be to complete a computer-based data entry task, we are looking at your level of performance throughout this study, so be sure to complete as many correct data entries as possible during the next 30 minutes. You will be compensated $4.50 for every session at the end of the study. If you feel tired and need a break, you may take a break and will not be penalized for taking the break. You can either just relax or play any of the available computer games.

There is a job aid for the task located next to the computer just in case you have forgotten how to complete the task.

The computer program will let you know when your session is over.”

**The research assistant will take the participant to his or her workstation in the laboratory room (2532 Wood Hall), start the session on the computer, and prompt him or her to begin their work session.

End of Introductory Session:

**The research assistant will let the participant know when his or her 30 minute session is over; the research assistant will then take the participant back to either 2510 or 2512 Wood Hall and schedule sessions.
Appendix S

Receipt for Compensation
Compensation for Study Participation:

Date: __________

Participant Name: _______________________

5 Sessions X $4.50 per Session

= $22.50 Total
Appendix T

Debriefing Scripts
**IF - Debriefing Session Script:**

**This script will be read aloud by the student investigator or a research assistant to each participant following the completion of the study.**

*As one last task, I would like to ask you to fill out this short survey and answer a few questions about your experiences as a participant in this study. Is that something you are willing to do?*

**The research assistant will give the participant the survey and ask the exit interview questions.**

*"Thank you for completing the survey and interview!"

*"Thank you for your participation in the study. The reason for this session is so that I can provide a brief explanation of the purpose of the study that you have just completed. Feel free to ask any questions following this brief explanation."

**The purpose of the current study was to evaluate three different types of graphic feedback. You were in a condition in which you received information about your individual performance only. The data related to your performance were accurate and the graphs were based on the actual number of correct data entries that you completed. There were (14-17) other people in your group who also received individual performance graphs.**

**There were also two other conditions, one in which participants received a graph of their performance and group average data points (show the sample individual/group average graph) and another where participants received a graph of their individual performance and the individual performances of other group members (show the sample SCF – individual performance for each individual graph).**

**The computer games were available because we wanted to see if having the option to play computer games vs. work on the task might change over time after you received feedback on your performance.**

**The research assistant will have a time sheet available that will be provided by the student investigator.**

*"You will now be compensated for your participation in this study. You completed five sessions throughout the study, and you will receive a total of (dollar amount equivalent to $4.50 per session) dollars."

**Do you have any questions or concerns about this study or your participation at this time?**

*Please do not discuss this study with anyone else because we are still in the process of debriefing other participants.*
SCF – GA Debriefing Session Script:

**This script will be read aloud by the student investigator or a research assistant to each participant following the completion of the study.**

As one last task, I would like to ask you to fill out this short survey and answer a few questions about your experiences as a participant in this study. Is that something you are willing to do?”

**The research assistant will give the participant the survey and ask the exit interview questions.**

“Thank you for completing the survey and interview!”

“Thank you for your participation in the study. The reason for this session is so that I can provide a brief explanation of the purpose of the study that you have just completed. Feel free to ask any questions following this brief explanation.

The purpose of the current study was to evaluate three different types of graphic feedback. You were in a condition in which you received information about your individual performance and information about average group performance. The data related to your performance were accurate and the graphs were based on the actual number of correct data entries that you completed. The data for the group average was based on the actual data of group members. There were (14-17) other people in your group, but you did not have access to their individual data.

There were also two other conditions, one in which participants received a graph of their individual performance (show the sample individual feedback graph) and another where participants received a graph of their individual performance and the individual performances of other group members (show the sample SCF – individual performance for each individual graph).

The computer games were available because we wanted to see if having the option to play computer games vs. work on the task might change over time after you received feedback on your performance.”

**The research assistant will have a time sheet available that will be provided by the student investigator.**

“You will now be compensated for your participation in this study. You completed five sessions throughout the study, and you will receive a total of (dollar amount equivalent to $4.50 per session) dollars.

Do you have any questions or concerns about this study or your participation at this time? Please do not discuss this study with anyone else because we are still in the process of debriefing other participants.
**SCF – IP Debriefing Session Script:**

**This script will be read aloud by the student investigator or a research assistant to each participant following the completion of the study.**

*As one last task, I would like to ask you to fill out this short survey and answer a few questions about your experiences as a participant in this study. Is that something you are willing to do?”*

**The research assistant will give the participant the survey and ask the exit interview questions.**

*“Thank you for completing the survey and interview!”*

*“Thank you for your participation in the study. The reason for this session is so that I can provide a brief explanation of the purpose of the study that you have just completed. Feel free to ask any questions following this brief explanation.**

*The purpose of the current study was to evaluate three different types of graphic feedback. You were in a condition in which you received information about your individual performance and information about the individual performance of other group members. The data related to your performance were accurate and the graphs were based on the actual number of correct data entries that you completed. The data for your other group members were also accurate and based on their actual performance, but all the names of group members were fabricated to protect their identities. There were (14-17) other people in your group.*

*There were also two other conditions, one in which participants received a graph of their individual performance (show the sample individual feedback graph) and another where participants received a graph of their individual performance and the average performance of the group (show the sample SCF – individual performance compared to group performance).*

*The computer games were available because we wanted to see if having the option to play computer games vs. work on the task might change over time after you received feedback on your performance.”*

**The research assistant will have a time sheet available that will be provided by the student investigator.**

*“You will now be compensated for your participation in this study. You completed five sessions throughout the study, and you will receive a total of (dollar amount equivalent to $4.50 per session) dollars.*

*Do you have any questions or concerns about this study or your participation at this time? Please do not discuss this study with anyone else because we are still in the process of debriefing other participants.*
Appendix U

Open-Ended Responses for All Participants
Question: Which of these three graphs do you think was the most effective to help you understand your performance?

Group One:
1. SCF-GA
2. SCF-IP
3. Individual Graph
4. SCF-GA
5. SCF-GA
6. Individual Graph
7. SCF-GA
8. SCF-GA
9. Individual Graph
10. SCF-GA
11. SCF-IP
12. SCF-GA
13. SCF-GA
14. SCF-GA
15. Individual Graph
16. SCF-GA

Group Two:
1. SCF-GA
2. SCF-GA
3. SCF-GA
4. SCF-GA
5. SCF-GA
6. SCF-IP
7. SCF-IP
8. SCF-IP
9. SCF-GA
10. SCF-GA
11. SCF-GA
12. Individual
13. SCF-GA
14. SCF-GA
15. SCF-GA
16. SCF-GA
17. Individual
18. SCF-IP
19. SCF-GA

Group Three:

1. SCF-IP
2. SCF-GA
3. Individual
4. SCF-IP
5. SCF-IP
6. SCF-IP
7. SCF-IP
8. Individual
9. SCF-GA
10. SCF-IP
11. SCF-IP
12. SCF-GA
13. SCF-IP
14. SCF-IP
15. SCF-IP
16. SCF-IP
17. SCF-IP
18. SCF-IP

**Question:** Do you think that any of these graphs are better or worse than others? Why?

**Group One:**

1. SCF-IP (worse) and Ind (Worse)
   a. Too much clutter or too little info

2. No
   a. No opinion

3. No
   a. No opinion

4. SCF-GA (better) and SCF-IP (worse)
   a. Too Complicated, don't get the full effect and best direction

5. SCF-IP (worse)
   a. Messy

6. Not really
   a. None
7. No
   a. No opinion

8. SCF-GA (better) and SCF-IP (worse)
   a. Too much going on with SCF-IP

9. No
   a. No opinion

10. SCF-IP (worse)
    a. Too much going on with SCF-IP

11. SCF-IP (better)
    a. More information

12. Individual (worse), SCF-IP (worse), SCF-GA (better)
    a. Vague, confusing, and pretty good and clean

13. SCP-IP (worse)
    a. Too much going on with SCF-IP

14. Individual (worse), SCF-IP (worse), SCF-GA (better)
    a. Individual (not enough info) and SCF-IP (would make me feel uncomfortable)

15. SCF-GA (better) and SCF-IP (worse)
    a. SCF-GA (looks the best to compare performance) and SCF-IP (confusing)

16. Individual (worse)
    a. Nothing compared

Group Two:

1. Individual (worse) and SCF-IP (worse)
1. Individual (no comparison) and SCF-IP (could be discouraging)

2. SCF-IP (worse)
   a. Worse colors too similar, hard to decipher

3. SCF-IP (worse)
   a. It gives names of people

4. SCF-IP (better)
   a. I like it for the competition

5. SCF-GA (better) and SCF-IP (better)
   a. Shows more data

6. SCF-GA (worse)
   a. You cannot see anyone else's except your performance and the group average

7. Individual (worse)
   a. Least useful, but great to show just 1 person; all have good reasons

8. Individual (worse) and SCF-IP (best)
   a. More information

9. SCF-IP (worse)
   a. Hard to read, all over the place

10. Individual (worse)
    a. Doesn't compare anything

11. SCF-IP (worse)
    a. Feel really good/bad depending on how you do, very competitive

12. No
    a. No opinion
13. SCF-GA (better)
   a. Others have either not enough info or too much info

14. Individual (worse) and SCF-IP (worse)
   a. Hard to keep track of (SCF-IP) and Don't have group info (Ind)

15. SCF-GA (best) and SCF-IP (worse)
   a. Too much information

16. Individual (worse)
   a. Cannot compare to anything

17. SCF-IP (better)
   a. Competition, when you can compare yourself to others, you will do better

18. SCF-IP (better)
   a. Group average is nice, but I prefer to see what is really going on; like the detail about people

19. SCF-IP (worse)
   a. Pretty messy

Group Three:

1. No
   a. No opinion

2. Individual (worse)
   a. You don't get to compare yourself to others

3. SCF-GA (worse)
   a. I don’t like averages

4. Individual (worse)
   a. Doesn't compare much
5. SCF-GA (worse)
   a. Don't know where you are standing

6. SCF-IP (better)
   a. It shows everyone's information

7. Individual (worse) and SCF-IP (better)
   a. Individual means nothing, with SCF-IP you can see everyone's data and progress

8. Individual (better) and SCF-IP (worse)
   a. Clear and the SCF-IP is cluttered

9. SCF-IP (worse)
   a. Hard to find yourself in there, but all are still useful

10. SCF-GA (worse)
    a. More stress

11. Individual (worse)
    a. Doesn't show anything

12. SCF-GA (better) and SCF-IP (worse)
    a. GA - more clear and IP is too busy and hard to read

13. Individual (worse) and other 2 (better)
    a. Ind-Worse to just see what you're doing and other two compares me to everyone else

14. No
    a. No opinion

15. No
    a. No opinion

16. SCF-IP (better)
    a. Gives a feel of how you're doing compared to everyone else
17. Individual (worse)
   a. Just yours, there is no comparison

18. Individual (worse)
   a. Cannot really tell what "good" is

**Question:** Do you feel that you changed your performance based on the feedback we gave you? Why?

**Group One:**

1. Yes
   a. Trying to beat previous performance

2. No
   a. No opinion

3. Yes
   a. Wanted to do just as well or better

4. Yes
   a. Get competitive with ourselves

5. Yes
   a. When it dropped, I wondered, then I changed the way I entered data

6. Yes
   a. A little bit, you want to do better

7. Yes
   a. Beat it each time

8. No
   a. Thought about it, but didn't change, would rather see how many I got wrong
9. Yes
   a. Wanted to do better

10. Yes
    a. Tried to pace myself more to get a high score

11. Yes
    a. Didn't want to do worse, which made me do better

12. Yes
    a. Tried to be as accurate and quick as possible

13. Yes
    a. Trying to beat previous performance

14. Yes
    a. Tried to do better than last time

15. Yes
    a. Trying to beat previous performance

16. Yes
    a. Sometimes, when I was really low, I wanted to do better

Group Two:

1. Yes
   a. I felt comfortable with the program, the data showed that

2. Yes
   a. I wanted to beat my previous score

3. Yes
   a. Tried to make myself better

4. Yes
a. I saw that I was below the group average so I wanted to do better

5. No
   a. No comment

6. No
   a. No comment

7. Yes
   a. Got a kick out of it, boosted my self-esteem

8. No
   a. No comment

9. Yes
   a. Beat the group average

10. Yes
    a. I usually tried to do better

11. No
    a. No comment

12. No
    a. No comment

13. Yes
    a. Not strongly

14. Yes
    a. Wanted to get closer to the group average

15. Yes
    a. Wanted to do better

16. Yes
    a. Aware, but not striving to beat anything
17. Yes
   a. Wanted to do better

18. Yes
   a. At first I was below average, and I wanted to be better

19. Yes
   a. Want to do better every time

Group Three:

1. Yes
   a. Made me work harder

2. Yes
   a. Made me feel better to do better, more motivating

3. Yes
   a. I just wanted to keep my performance up and keep getting faster

4. Kind of
   a. If my performance went down, I wanted it to go back up

5. Yes
   a. I was competing

6. Yes
   a. I saw how bad I did and I wanted to improve based on everyone else

7. No
   a. No comment

8. Yes
   a. Wanted to beat the last score

9. Kind of
a. Some days I felt like pushing myself and some days I didn't care

10. No
   a. No comment

11. No
   a. No comment

12. Yes
   a. I wanted to improve and do better

13. Yes
   a. Made me want to make my scores higher after seeing what others were doing

14. Yes
   a. To do better and improve

15. Yes
   a. I tried to be faster, more accurate

16. Yes
   a. Tried to get better than the last one

17. Yes
   a. If I was not doing as well as others, then I was going to try harder

18. Yes
   a. My performance was more positive from looking at the graph

**Question:** Do you think that you would have tried harder than you would have if we did not provide any feedback graphs? Why?

**Group One:**

1. No
   a. No challenge or objective to go faster
2. No
3. No
4. No
5. No
   a. Nice to see progress and numbers, I wanted to do better
6. No
7. No
8. No
   a. Confused
9. No
   a. Would not have tried harder
10. No
11. No
12. No
   a. Wouldn’t know how good or bad I was doing
13. No
   a. Wouldn't have any target
14. No
15. No
   a. If I didn't know, I would not have done better or worse
16. No
   a. Wouldn't know what to compare to

Group Two:

1. Yes
a. Yes, but the graph improved my motivation

2. No
   a. I would not know how I was doing

3. No
4. No
   a. No competition shown

5. No
6. No
7. No
   a. Great to get good feedback, better to get feedback. When you don't know what you are doing wrong, it's hard.

8. No
9. No
10. No
   a. I wouldn't have any comparison

11. No
12. No
13. No
   a. Info provides a personal goal

14. No
   a. Trying to get close to it or beat it, without feedback, no motivation to go faster

15. No
   a. Wouldn't have known how well I was doing

16. No
17. No
18. No
   a. Monotonous without feedback

19. No

Group Three:

1. No
   a. The motivating factor would not be there.

2. Yes
   a. I still would have felt if I was doing better or worse

3. No
   a. I wouldn't have seen any sort of progress

4. No
   a. If I didn’t get any feedback, I would not have thought too much about my performance

5. No
   a. I would have just done the task, the feedback made me want to do it better

6. No
   a. Wouldn't know how well I was doing and compared myself to everyone else

7. No

8. No

9. No
   a. I would have no way of knowing if I did good or bad

10. No
    a. If I didn't know, I wouldn't think, and would perform at the same speed
11. No
12. No
13. No
   a. Because I would have stayed the same, you cannot make yourself better without comparison to others
14. No
   a. No comparison
15. No
16. Yes
   a. Just to know that I did better. "Personal satisfaction" thing
17. No
   a. The graphs give incentive
18. No
   a. Maybe not as conscious of trying to improve