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Feedback and Social Comparison: The Effects of Comparing One's Performance to the Group

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by

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Abstract

Feedback and Social Comparison: The Effects of Comparing One's Performance to the Group

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Although feedback has been shown to improve performance, few studies have examined the effect of feedback containing information on peer performance. The purpose of this study was to evaluate the effects of feedback on individual performance and feedback containing information on peer performance. Three participants were exposed to a no-feedback baseline condition, a standard individual feedback condition, and an individual feedback condition with information on the group's average performance. The dependent variable was the rate of correct responses on a computer-based simulated work task. Withdrawal designs were used to evaluate the effect of the two types of feedback on performance. Mixed results were obtained across three participants. For one participant, no systemic difference between any condition was observed. For the other two participants, both feedback alone and feedback with group performance information increased performance above baseline rates. However, no differences were apparent between the feedback conditions for either participant. The results of this study provide further support for feedback as an effective intervention; however, social comparison feedback did not produce a greater increase in performance relative to non-social comparison feedback.

Keywords: feedback, group performance, social comparison

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Chapter 1: Feedback and Social Comparison:

The Effects of Comparing One's Performance to the Group

Introduction

Feedback is defined as information about performance that allows a person to change his or her behavior and is a commonly used intervention to manage employee performance in organizations (Daniels & Bailey, 2014). A recently published literature review of 96 applications of feedback from 71 articles in the discipline of Organizational Behavior Management (OBM) indicated that feedback produces large effect sizes (Sleiman et al., 2020). One type of feedback which has received a dearth of attention in the literature is feedback which includes information on the performance of peers. Comparing one's performance to others may have produce large increase in performance. On the other hand, this type of feedback may increase competition between employees and might not be acceptable in some organizations. The purpose of this study is to compare simple feedback on performance to social comparison feedback.

Although feedback has been studied by disciplines outside of OBM, the focus of the current study is research that has been conducted within OBM, which is the application of behavioral principles to organizations. OBM is a sub-discipline of Applied Behavior Analysis (ABA) and thus has a different theoretical base than other disciplines like Organizational Behavior and I/O Psychology (Bucklin et al., 2000).

Overview of Behavior Analysis

Behaviorism is the underlying philosophy of behavior analysis that states that we can and should be studying the behavior of organisms, and that scientific and experimental methods can be applied to this focus. Behavior analysis includes four sub-domains. The conceptual analysis of behavior is the study of the philosophy, methodology, and theory of behavior analysis. The experimental analysis of behavior (EAB) focuses on the basic principles of behavior. A common characteristic of this branch is the focus on only a few organisms with intense and extensive observation. EAB and ABA take an inductive approach to research. That is, instead of developing and testing formal hypotheses, EAB and ABA researchers examine the effects of independent variables without attempting to prove or disprove a theory. Within-subject research designs (Johnston & Pennypacker, 2020) are used to evaluate these effects and typically, few subjects participate in each study. Generalization is established via replication across populations and settings.

Applied behavior analysis (ABA) applies the basic principles outside of the laboratory setting. Though application of knowledge is the common form that research takes in this branch, novel discoveries that may be adopted into the body of knowledge are possible. The final branch, in which the majority of individuals who practice behavior analysis would be categorized, is behavior analytic service delivery. These individuals do not delegate a significant portion of their efforts to research. Instead, they act as practitioners and consultants, developing plans and

implementing interventions that are based on the behavior analytic body of knowledge. Those involved in direct services are usually registered behavior technicians or case managers in either clinics or homes dealing with clients diagnosed with intellectual and developmental disabilities. But regardless of whether or not a behavior analyst focuses on research or delivering services directly, their actions will fall within the framework of ABA.

Baer, Wolf, and Risley (1968) published an article in which they define ABA. In it, they discussed seven dimensions of the field. The dimensions are applied, behavioral, conceptually systematic, generality, analytic, technological, and effective. Applied refers to the notion that behaviors that are being studied should be of practical and social significance. Behavioral states that as researchers and practitioners, behavior analysts should focus on behaviors rather than hypothetical constructs, such as the mind, that are usually referenced in psychological literature and in common language. The interventions used by behavior analysts must be based on the basic principles from the body of knowledge within the field; they must be conceptually systematic. Generality is defined by the extent to which changes in behavior should transfer across settings and contexts. ABA must also be analytic in nature, meaning that we must formally analyze the effect of our procedures. Another dimension that is described is technological; all procedures and interventions must be described succinctly and clearly as to permit future replication for other researchers. Finally, and arguably

the most important, the dimension of effectiveness refers to changes in behavior being meaningful and practical for either the client or participant.

As previously discussed, much of psychology looks to internal states to describe the reasons that people do what they do. They hope to develop theories to explain why we do what we do and to predict our future actions. Behavior analysis looks to environmental influences on an individual's behavior and focuses on the observable behaviors of people. This focus on the observed has laid the groundwork for one of the main points of disparity between behavior analysis and other psychological disciplines and that is the lack of theories. In behavior analysis, much of what is studied and researched currently is based on principles of behavior established through thousands of replications to the point that they are considered laws of behavior. ABA involves taking the behavioral principles developed from experimental research and focusing their application on behaviors that are considered socially significant (Baer, Wolf, Risley, 1968). From this, there are several practice areas that fall under ABA, including autism and intellectual/developmental disabilities, behavioral gerontology, and organizational behavior management (OBM), which is the focus of this study.

Overview of OBM

OBM takes the technology and principles developed in ABA and applies them to behaviors that are relevant to organizations. The goal of OBM is to generate performance improvement on an organizational-wide scale, improve the productivity and efficiency of employees, and more efficiently achieve the mission

defined by the organization (Daniels and Bailey, 2014, p.55). There are three subfields under the umbrella of OBM: performance management (PM), behavioral systems analysis (BSA), and behavior-based safety (BBS).

Performance management focuses on the performance of employees at the individual level (Daniels and Bailey, 2014, p.1). PM employs assessment techniques to determine the environmental influences on performance. Interventions, both antecedent-based and consequence-based, are used in PM. A strength of performance management is the consequence-based interventions that will help maintain the performance improvements that accompany other interventions. Reinforcement is responsible for the maintenance of all behaviors regardless if they are desirable or undesirable for the individual, department, or organization. The feedback provided in the current study was intended to act as reinforcement and thus increase the rate of correct responding, which was the target behavior. Aside from consequent interventions, OBM practitioners may also focus on improving an organization by focusing on their systems and processes.

BSA acknowledges that organizations are complex systems and that influencing and changing one aspect can have great impacts on other departments and functions of the organization (Diener et al., 2009). One of the main tools that BSA uses is not unique to the field of behavior analysis but is a rather common tool (the process map) found in many disciplines that look to improve organizations. The process map is a tool used to identify the appropriate steps in a process and whether or not a disconnect exists in a process. Using the map, consultants are able

to see if resources need to be reallocated, realigned with the goals of the organization, or if a change of processes is appropriate (Diener et al., 2009).

Another major focus of OBM is increasing the safe behaviors of employees; this is known as BBS. BBS focuses on both the organizational and the individual level to determine what environmental factors are either occasioning or maintaining unsafe practices of employees. There are several tools that have been developed to assess these environmental influences on unsafe behaviors, including the PDC-Safety (Martinez-Onstott et al. 2016). BBS practitioners often conduct safety assessments and create safety plans to decrease accidents and injuries.

Across many practice areas of OBM, interventions can be classified in to one of two types: antecedent or consequence-based (Austin et al., 1999). Antecedent interventions are a class of interventions that relate to all of the actions management and consultants take before a specific response. These are usually used when management concludes that a response is occurring because the employee is unable to or perform the desired behavior at the desired level of performance. A common example is training, which usually occurs when a new employee is hired into an organization and management wishes to teach the employee the information needed to perform a task. Another antecedent-based intervention is task clarification. Task clarification addresses behaviors that the subject or employee may already have in their repertoire but is not performing a task to the level required by the organization or department. Another antecedent intervention is the use of prompts, usually visual, which act as a means to bring

forth a proper response. These may consist of signs that are placed in areas in which a certain desirable response should occur. An example would be the handwashing signs found in bathrooms for employees, wet floor signs found in hallways, or "safe-standing" areas in a manufacturing plant. Finally, consultants and management may also look at the effort required to perform certain tasks and responses to either bring forth or limit the occurrence of a behavior. For example, if one was to redesign the work area to have materials labeled and in specified areas to be returned after use, while also being within close proximity of where the materials would be used, effort has effectively been decreased for cleaning up. For undesirable behaviors, one could increase the effort to perform such behaviors. Though antecedent manipulations could have been incorporated into the current study, feedback was treated as a consequence rather than as a prompt.

Management and OBM consultants can also alter the likelihood of behaviors through the control of specific consequences. The broad class of consequences refers to any stimulus that follows the response. A consequence can be classified as either a reinforcer or punisher by either increasing or decreasing the likelihood of the behavior, respectively. A common consequence procedure, and one that will be discussed in greater detail below, is feedback. Feedback is a procedure commonly found within an organization and is often delivered by the employee's supervisor. It is used to address behaviors that the manager would like to see increase or decrease. Another, and more obvious consequence, is the use of money as a reinforcer. It is a folly for a manager to think simply because an

employee is being paid to perform, that he or she will perform tasks efficiently, let alone to the best of their ability. The most effective forms of reinforcement are those that are presented immediately after the response, tied to a specific response, and have been shown to increase a participant's performance. Typical, salary-based pay delivered every other week fails at least two of these qualifications.

Consequences will fall under a class of either reinforcement, punishment, or extinction whether or not it is intentional or directed at the behaviors of interest. Being able to identify all the behaviors that lead to a certain result or outcome and the corresponding consequences are essential to effectively increase performance and decrease the sub-optimal behaviors. Common consequences for performance management include the presentation of rewards or recognition and feedback. The OBM literature has shown that feedback is an intervention that has robust effects on performance. The underlying mechanisms that make feedback effective are both context and individual specific. Depending on the details of its application, feedback can act as a punisher or a reinforcer. To act as simply one of these consequences, the feedback would be fairly limited in complexity and length. A more common and practical form of feedback will contain multiple aspects that will address multiple behaviors.

Overview of Feedback

Feedback is an intervention that produces robust results on the performance of an individual (Alvero et al. 2001). Some specific aspects that must be addressed when using feedback are the frequency, whether or not it is specific to behavior or

just results, the agent and mode of presentation, and any additional or supplemental aspects included with the feedback.

Many articles have been published analyzing the overall effectiveness of the different feedback frequencies including daily, weekly, and monthly. Alvero et al. (2001) showed that from their review of the literature, feedback presented daily, monthly, or a combination of daily and weekly showed consistent changes in performance. In total, they reviewed 64 articles and used them for their analysis. Their review looked at articles published between the years of 1985 and 1998. They focused on the four journals that were also reviewed by Balcazar et al. (1985), which was the predecessor of this study, *Academy of Management Journal, Journal of Applied Behavior Analysis, Journal Applied Psychology, and Journal of Organizational Behavior Management*. Their inclusion criteria stated that the published article must be a "field" or "applied" study and must have the term "feedback" used in either the abstract or in the methods section.

More recently, Pampino et al. (2004) found that daily feedback was more effective than weekly, however in the context of a treatment package there was no difference in effectiveness. The authors also noted that as far as efficiency goes, there is little difference between the two frequencies, which is an important note as far as response effort goes. If providing daily feedback proves to be too effortful or time consuming, it may punish the act altogether. If weekly feedback is more ideal from the supervisor's perspective, it can increase the likelihood that providing feedback will maintain and persist well into the future because of the relatively

lower response effort. In the current study, feedback was provided immediately after every session when participants were in the test conditions. However, due to the proximity from one session to another, feedback could also be considered as being provided immediately prior to the subsequent session (Aljadeff-Abergel et al. 2017).

Aside from just providing feedback frequently, it is important to know and take in to account what exactly is being communicated with whomever is receiving the feedback. The content of feedback could focus on the performance of an individual and compare it to the previous performance. An individual's performance can also be compared to a goal or standard when previous performance is not available. Feedback can also constitute information about the performance of a group compared to the previous performance of the same group or compared to other groups. Of course, this is not an all-inclusive list, feedback can be made up of any combination of group or individual and self to other comparisons. Behavior analytic research recommends that when feedback is delivered, it is best to keep it focused on objective and observable behaviors, which is what the participants of this study were exposed to (Daniels and Bailey, 2014, p.163). It is a common fault that supervisors may include in their feedback or base the entirety of the feedback on subjective measures. For instance, a supervisor might evaluate an employee and say they lack "drive." These statements provide little to no guidance on how an individual can improve to aid the organization. An approach that falls under the scope and recommendations of behavior analysts is to

use specific behaviors to guide the individual's performance change. In the previously mentioned example, we could improve the hypothetical feedback by dissecting what led to the use of the word "drive" to identify the behaviors that we wish to see increase. A lack of drive could instead be defined as anything from rarely enlisting in professional development opportunities to poor attendance. Being unfriendly in regard to new customers could be redefined as not approaching new customers, having a short duration of interactions, or even body language including lack of eye contact or posture and orientation towards customer. An important nuance when determining what behaviors should be focused on, we must prioritize the prevalence of behaviors rather than absence of behaviors or a result of those behaviors (Daniels and Bailey, 2014, p.167).

A study by Park et al. (2019) looked at the effects of feedback that were either specific or global and if feedback was given frequently or infrequently on job performance. Eighty participants were gathered and placed into one of four groups. The groups consisted of exposure to feedback that was either global and frequent, global and infrequent, specific and frequent, or specific and infrequent. Their results indicated that specific feedback was more effective than global and frequent was more effective than infrequent. They also found an interaction such that if feedback is given infrequently but is specific, it will be more effective than global. The influence of feedback that is either global or specific on individual performance was comparable in effectiveness as long as it was frequent.

The previous paragraphs described how the content of the feedback can influence the effectiveness of feedback in general. It was mentioned that feedback on an individual's performance could be provided in conjunction with information on the group's total performance or the performance of others. This type of feedback touches on a debate within the field of behavior analysis. Having information on your performance as well as that of your colleagues can potentially breed competition within your organization or department. On the other hand, providing only the group's performance coupled with your own provides enough anonymity where competition and social comparison can be avoided. Regardless of whether or not competition is harbored within your organization, there is little experimental research on the matter. Daniels and Bailey (2014) suggest that competition within an organization is ill-advised. This is because it may lead to unethical behaviors like lying, cheating, and stealing of customers (pg.29). However, this may be due to improper establishment of mission, vision, and values of an organization. Under some circumstances, competition among employees within organizations may be useful, but research on this is unclear.

Johnson and Dickinson (2010) looked at the efficacy of an employee of the month incentive program in which competition is typically harbored. Their findings indicated these programs do not lead to maintained increases in performance if performance increases occur at all. In their discussion and review, the researchers described that some possible detrimental effects of competition may include sabotaging others or the development of unhealthy levels of competition. The

researchers also described how for those that do not win the award, even if they have high levels of performance, they would not be receiving reinforcement. In the review done by the authors, competition for a single reward is typical and may be the root cause of undesirable behaviors. However, removal of the lone award and the presentation of the feedback with information on group performance may still lead to competition but reinforcers and awards that can be offered to everyone may alleviate the motivators for undesirable behaviors.

Even though the frequency of feedback may be the most important component when implementing a feedback-based intervention, it cannot be the only aspect one focuses on, if she or he wishes to achieve desirable effects. There are many ways in which feedback can be delivered. Some common delivery modes include graphs, written feedback, or oral feedback.

Alvero et al. (2001) revealed that the most common form of feedback was written feedback by itself. These authors examined forty-three different studies that had sixty applications of feedback. For their analysis, they categorized the applications as either effectiveness of the feedback, if the feedback was coupled with another intervention, and the essential characteristics of feedback. After analysis, they found that the form that produced the most consistent effects was when feedback was given graphically, coupled either with vocal feedback or written feedback. The conclusion can be made, that even though written feedback alone is common, it is also not the most effective. This shines a light on the common problem behavior analysts face, which is that people tend to act with what

requires the least amount of effort compared to what they were doing before an intervention is proposed. Similar to the problem seen with changing the frequency of feedback, researchers and consultants must alleviate the increased effort involved with adding a component or completely changing it. This is why consultants commonly seek out a way to either systemize their recommendation, or by supplying reinforcers for using the new feedback system until the natural contingencies act as a reinforcer.

There are several aspects to feedback which can seem like nuances but can drastically influence either the effectiveness or the convenience of feedback implementation. A seemingly minor consideration to make when deciding the feedback method is the agent, or who, will be delivering said feedback. Feedback can come from a variety of sources, including supervisors, researchers, self-generation, or even mechanical devices. The most common agent of feedback is the supervisor or manager. Something else to consider is a mechanical form of feedback which may require a substantial amount of effort initially but once implemented will require little to no effort to maintain. Berger and Ludwig (2007) have used mechanical devices to give automatic feedback within a selection process for the food industry. The use of mechanical devices can be designed to provide strictly objective feedback, immediately, and one can control the frequency of the feedback from the device or tool regardless of the availability of a supervisor as well as the latency of the feedback.

Feedback and Social Comparison Studies

With feedback on one's performance being presented; information may also be provided on peers or a group that one finds themselves working within. Though it may not be formally practiced by an organization, social comparison can result from having access to information on others. Van Houten et. al (1975) looked at the effects of timing and feedback, timing with feedback and public posting of performance, and feedback coupled with public postings of performance and praise while also including timing. The participants in their experiment were two fourth-grade classes in a classroom while the dependent variables were rate of words written, time on-task, and comments on performance. Each of the interventions lead to an increase across all dependent variables for both classrooms over baseline. Feedback and timing lead to an increase in performance while adding public posting further increased performance. The highest level of performance was achieved when the previously mentioned intervention was presented with praise. The researchers were able to show the efficacy of providing performance feedback. Though not directly targeted nor put under scrutiny, the addition of public posting of performance shows that information on peers can increase performance of an individual.

In one of the first social comparison studies, Panyon et al. (1970) applied a feedback intervention with the staff of a state institution to increase the number of sessions run regarding training. The intervention was feedback sheets being presented to the staff of specified "Halls," with the number of possible sessions for

each skill, the number of sessions recorded and conducted, and the name of the staff member who completed each session. The average performance of each of the four halls was also ranked and presented on the feedback sheet. The results of their study showed that number of sessions run increased dramatically for all halls once feedback was presented. The results also maintained for all halls. This study, like the one mentioned in the previous paragraph, also did not directly test the influence of information on others or social comparison but was rather included as a part of a treatment package. Though it is not possible to determine how much of an effect the additional information on the other hallways and their rank had on the increases in performance, we can determine that it, coupled with individual feedback, can lead to dramatic effects on performance. It is important to note, that the researchers mentioned that they provided the ranked information to the participants in hopes of comparison by the individuals.

Performance increases caused from the implementation of feedback can also be seen in typical factory settings as well. For instance, Emmert conducted an experiment in a manufacturing setting that spliced bobbins (1978), which is a spool or spindle that yarn or wire is typically wrapped around. Data were collected on the average amount of bobbins spliced per eight-hour shift for four different “crews” as well as for the whole department. The first condition they implemented was the average results for each of the crews as a whole being posted publicly on a graph. This intervention led to slight increases for two of the four crews. The second intervention was individual feedback on each individual operator’s performance

while also keeping the public graph in place. This also led to an increase in performance for two of the four crews. A third intervention was put in place for one of the crews since the foreman admitted to not properly providing reinforcement and daily feedback that was strongly encouraged by the researchers. When the second intervention was put in place, there was a further increase in performance which may suggest that once an individual has information on themselves as well as information of a group or other groups, performance may continue to increase.

Another study in which public feedback was used as a part of an intervention was conducted by Rose and Ludwig (2009). The researchers focused on the sanitation tasks at a pool that were to be completed by the lifeguards. The intervention consisted of task clarification, self-monitoring, and performance feedback being graphed and publicly displayed. The researchers were able to increase the number of tasks completed from 45% in baseline to 77%. The researchers also withdrew the intervention package and task completion fell to 45%. Since the intervention was a package, it is difficult to identify the specific component which provided the greatest influence on behavior change. Again, public posting provided information to all participants on the performance of others which may lead to social comparison. This comparison may have had an additive effect to the influence from feedback alone. Even though public posting of performance has been shown to be an effective intervention (Ludwig et al. 2002; Nordstrom et al. 1991; Palmer & Johnson 2013), researchers of the current study were unable to utilize this in the current study and opted for vocally presenting

objective feedback. The objective feedback presented to participants was information on the rate of their correct responding (Sigurdsson & Ring, 2013).

The current study is based on the findings and methodology used by Moon et al. (2017). Moon and colleagues looked at the effects of objective feedback compared to social comparison feedback amongst two groups of performers, high and low. Using two groups of sixty college-aged students, they performed an analog task. Participants and data were divided into four groups based on performance level and the content of their feedback, leading to a 2 x 2 factorial design. Feedback content was considered objective in which they received a numerical value for the amount of completed tasks. Social comparison feedback was in the form of an individual's ranking in the group as "__ out of 60." The participants were asked to complete an analog task simulating an online bank transfer and the data produced acted as the dependent variable. Once the data were collected, it was analyzed using a one-way ANOVA. The results of their study lead to the conclusion that for those who were considered high performers, social comparison feedback significantly improved performance. They were also able to conclude that for the low performers, social comparison feedback was less effective.

The previously mentioned study laid the foundation for the current study for which the objective is to expand on their findings. The current study used single-subject withdrawal designs to compare two different interventions. With single - subject designs, there is no assignment to control or test groups; rather, each

individual is exposed to all conditions. Data across various phases or conditions are compared within the same individual. Subjects participating in the experiment were exposed to a baseline, feedback only, and a feedback and social comparison to group performance condition. The purpose of the current study was to compare the effects of the presentation of objective feedback and feedback presented with social comparison information.

Chapter 2: Method

Participants

The participants in this study were one undergraduate female at the Florida Institute of Technology (Florida Tech), and two recently graduated males from the University of Florida. Alexandria, the Florida Tech student, was a Caucasian twenty-one-year-old in her fourth year. Patrick was an African American twenty-three-year-old who was employed at a financial service company. Austin was a twenty-three-year-old Caucasian male who was in his second year of law school. At the completion of the study, participants were awarded a fifty-dollar electronic gift card for their time and efforts. This card was provided contingent upon study completion, independent of performance.

Settings and Materials

Sessions were conducted remotely. Participants used their own personal computer. The analog task was run using Microsoft Excel™ through the Canvas™ learning management system (LMS). Meetings were conducted using video conferencing programs. Subjects were required to perform a simple data-entry task. At the start of the study, participants were given a spreadsheet that contained a simulated patient name linked to a randomly generated ID number (see figure 1). On a second page of the spreadsheet, the names were removed, and the ID number was linked to a procedure performed. On the third page of the document, a list of procedures and their prices was present. Each session took the form of a ten-minute quiz in the LMS. A total of seventy-four questions were presented to prevent a

potential ceiling effect. Each question was presented one at a time and would lock once a participant moved to the next question. Each multiple choice question included just the name of a patient. The answer choices consisted of the corresponding ID number, procedure, and price. After ten minutes, the quizzes would automatically lock, and no scores were presented to the participant. All sessions were ten minutes in duration.

Experimental Design

Each participant was exposed to every condition in withdrawal designs, but in various juxtapositions. The three conditions were baseline, feedback, and feedback plus group performance information. During the baseline condition no feedback on performance was given (Condition A). During the feedback only condition, information on the participant's performance (Condition B) was provided. During the feedback plus group performance condition, participants were exposed to feedback on their own performance as well as information on the group's performance as a whole (Condition C). The order of conditions to which Alexandria was exposed to was ABABACAC. Patrick was exposed to the conditions in the order of ABACACAB. Austin was exposed to an ACABABAC order.

Pre-Experiment Exposure/Task Training

Participants were exposed to an analog task which imitated simple data entry. In the pre-exposure condition, the subjects had two minutes to interact with the task and were able to ask questions in relation to the task. No feedback in

regard to performance was given. At the start of the experiment, during the first exposure to the task, participants were told that the purpose of the study was to test the efficacy of the analog task. At the end of the experiment participants were debriefed on the true nature of the study.

Baseline

During baseline, the subjects were asked to perform the analog task. At the end of the session, the researcher returned to the virtual meeting to collect the data from the program. The experimenter did not provide the participant any feedback on their performance nor did he answer any questions pertaining to the task.

Feedback Only

As in baseline, the participant was given ten minutes to perform the analog task. At the end of the ten-minute session the participant was then given feedback on their performance from this session. The feedback was given in the form of a number that stated the rate of correct responding for the session that just occurred. For instance, after a session in this condition, the experimenter would return to the virtual meeting room and vocally communicate that the participant had correctly responded to 3.4 questions per minute.

Feedback + Social Comparison to Group

As in baseline, participants were asked to perform the analog task for a duration of ten minutes. Prior to the start of session, the participant was told the performance of the group. The rate of correct responding showed the average rate of correct responding for the group. The value was determined by calculating the

average rate of performance from all participants in test conditions. This value was updated after every session. At the end of the ten minutes, feedback on the individual participant's performance in the form of a numerical value indicating the rate of correct responding was delivered by the experimenter, just as in the feedback only condition.

Social Validity

At the end of the study, participants were given a survey to assess the social validity of the methodology and the intervention (figure 2). The survey included a standard five-point Likert scale consisting of the following questions: 1) I found this study to take a reasonable length of time; 2) I enjoyed receiving information on how the group is performing; 3) I found receiving information on my own performance important; 4) I feel that knowing how the group was performing improved my own performance; and 5) The information presented to me regarding performance was pertinent. A question on participant preference for each feedback condition, as well as a question on any perceived adverse effects of the social comparison condition, was also included.

Chapter 3: Results

Figure 3 depicts results for Alexandria. For Alexandria, visual analysis did not identify any changes in rate of performance during the first five conditions. During the first baseline condition, Alexandria had a mean performance of 2.68 correct responses per minute. Alexandria's first feedback alone condition had an average performance of 2.72. For the second baseline condition, her performance averaged 2.9 responses per minute, and her performance for the second feedback alone condition averaged 3.04 per minute. For the last four conditions, which consisted of two feedback and group information conditions and one baseline condition, feedback with group information increased her performance. Alexandria's mean performance for the third baseline was 2.82 responses per minute and her performance for the first feedback plus group information was 3.62 responses per minute. Finally, for her last baseline condition, her mean performance was 3.47 while her last feedback plus group information performance was 3.68 responses per minute.

Figure 4 depicts Patrick's data. Across the first four conditions, there appeared to be a moderate increase from each condition to each subsequent condition. Patrick's performance in the first baseline condition was 2.28 correct responses per minute. For his first feedback only condition, he averaged 2.87 correct responses per minute. For his second baseline condition, Patrick performed an average of 3.18 responses per minute, and during his first feedback plus group information condition, he averaged 3.3 per minute. After the last session in the first

feedback with group performance condition, the experimenter restated, prior to each session, if Patrick would be receiving feedback, and whether he would be receiving group performance information. In addition, a written statement indicating feedback availability within each quiz was also included. For Patrick's subsequent conditions, differentiation in responding was observed. The average performance for Patrick's third baseline, second feedback plus group information, fourth baseline, and second feedback only conditions was 2.93, 3.56, 3.17, and 3.77, respectively.

Figure 5 depicts Austin's data. The data for Austin showed no effect from the implemented interventions. Over the course of all eight conditions, forty-three sessions in total, an increasing trend is apparent. The increase in performance was shown regardless of condition. As with Patrick, the experimenter introduced a statement regarding whether or not the participant would be receiving feedback or group information and an additional written statement halfway through the study to aid in the in differentiation between conditions. However, even with the inclusion of these stimuli, no change in the rate of Austin's performance was evident. His performance in the first baseline condition and feedback plus group information condition averaged to 2.6 and 2.93 responses per minute, respectively. During Austin's second baseline condition, he averaged 3.25 responses per minute. For his first feedback only condition, Austin averaged 3.63 responses per minute. For Austin's third baseline condition, he averaged 4.25 responses per minute and during his second feedback only condition, he averaged 4.58 responses per minute.

In the last baseline condition, Austin averaged 4.63 correct responses per minute and for the last condition, feedback with group information, he averaged 5.08 responses per minute.

A social validity survey was presented to all three participants at the end of the study. For all questions, Patrick noted that he strongly disagreed with all statements in the survey. To summarize, he found no value in receiving feedback nor information on the other students according to his responses on the Likert scale. However, on the free response portion he did indicate that he preferred the condition in which he was presented feedback and information on the group. Austin, similar to Patrick, disagreed with all statements, but also had a preference for knowing how the other participants were doing. As for adverse effects, neither participant mentioned any such effects but rather indicated that they were satisfied knowing that they had been performing above the group mean performance. Alexandria's responses to the survey differed from the other two participants. She agreed with them in regard to the benefits of receiving information on her own performance. However, she either somewhat agreed or strongly agreed with the perceived value and pertinence of information on group performance.

Discussion

The purpose of this study was to compare feedback to feedback coupled with information on group performance on rate of performance during an analog task. As described in the introduction, objective feedback typically leads to robust changes in performance. It is also common for information on how a group is

performing to be disclosed, whether it is related to a class's performance on an exam, specific behaviors of employees during certain shifts, or with athletes in sports.

The current study showed that, relative to baseline, feedback only and feedback with the group's data increased performance for two participants (Alexandria and Patrick). Alexandria's results also correspond with previously described studies that looked at how making information on others' performance available to other performers can influence rates of responding. Emmert (1978) showed that both publicly posting performance for a shift while also providing individual feedback or public posting of a crew's performance alone could increase performance. Though not publicly posted for participants, the participants in the current study were presented with data on how the average of the group as a whole was performing at the start of every session when in the corresponding condition. Despite this, robust changes were not apparent in the first half of the study; control was shown for two of the three participants (Alexandria and Patrick) once additional stimuli were incorporated.

Patrick showed a higher rate of responding in the second presentation of feedback and feedback plus group information as compared to baseline conditions. Though difficult to identify strictly from visual analysis, once the mean for the two conditions was calculated, feedback alone increased performance slightly more than feedback with group information. Alexandria's data showed that feedback plus

group information, in both presentations, lead to higher performance over baseline as well as the previous two feedback alone conditions.

The results from Alexandria and Austin support previously discussed literature. Feedback in this study, as well as feedback with group information, lead to a salient increase in performance for the participants. The results of the current study somewhat support those of Moon et al. (2017). Results showed that of their sixty participants, high performers improved with social comparison feedback while less significant improvements were noted among low performers. In the high performer group, social comparison data were shown to increase performance over objective feedback. The current study did not take into account whether someone was considered a high or low performer. The results from the current study showed mixed effects. Based on the mean of Patrick's performance, feedback lead to a greater increase in response rate than feedback with group information. Alexandria's results support the results of Moon and colleagues in that her performance produced a robust increase in performance over baseline and feedback alone.

The study conducted by Moon et al. (2017) used statistical analysis to identify performance differences. After the analysis, it was revealed that the main effect of the type of feedback provided was not significant, but the interaction effect was shown to be significant. When social comparison information was presented to high performers, a significant increase in the mean performance was indicated over those who received objective feedback. However, low performers

showed a greater improvement in performance when presented with objective feedback as opposed to social comparison feedback. The authors did note that between the pre-experimental session and the first experimental condition, few changes in performance were evident between the two levels of performers. In subsequent conditions, changes in performance became more apparent. Essentially, depending on the performer's level, social comparison feedback can serve multiple functions.

Austin's data showed a continuous increase in the mean rate of performance for every condition across the course of the study. His results are a prime example of the practice effect, in which the changes in performance are due to repeated exposure to the task. These results highlight a limitation of the study. The failure to account for an individual's learning history may decrease the effectiveness of an intervention. Some individuals may not be as sensitive to social contingencies as others. For Austin, the types of feedback, if either was presented, had no salient effect on performance. This aligned with what was identified in the social validity survey in which Austin had indicated no interest nor value in receiving feedback nor information on the group's performance.

Alexandria's response to how she felt regarding receiving feedback on her own performance corresponded well with her performance in the study. She showed little difference between her performance in the feedback alone conditions and baseline while indicating that she did not find information on her own performance important. According to her survey response, she scored information

on how the group performed as important and her data also corresponded with this. Her performance increased when presented with feedback as well as group information.

For both Alexandria and Patrick, feedback and feedback with social comparison data increased their performance over baseline. Alexandria exclusively had a slight performance increase from exposure to the social comparison condition. This could be due to the reinforcing effects of performing better than peers or avoiding performing worse than her peers. Patrick, aside from finding feedback to be reinforcing, may have used the social comparison information to set a goal. Depending on the value presented as the group's performance, Patrick may have performed in a way that would approach the average performance of the group rather than simply trying to surpass his previous score which may have been the case in his feedback alone condition.

The purpose of the social validity survey was to evaluate the extent to which the participants approved of the study itself and the social comparison feedback. For instance, two of the three participants indicated that this study took an inappropriate amount of time. This could be used to guide future researchers to design experiments that limit the time required, unlike the current study that had no such limit.

The feedback presented in this study was simply the rate of correct responses from the prior session, and variations of feedback may have led to different results. One aspect to change in future research would be the frequency of

feedback that was given. In the current study, feedback was given after the ten-minute session but presented after every session. Live feedback or feedback presented during the session while the participant is responding may have strengthened the relationship between the behavers responding and the feedback. Latency between inputting the answer in the quiz and the feedback being presented would be decreased to as immediately as possible. As shown by Barker et al. (2019), immediate feedback during training lead to greater acquisition, maintenance, and generalization than feedback delivered after each session. Another aspect of feedback that can be studied would be when the feedback caters to more complex tasks. Having more complex feedback that may refer to a complex component like quality of performance should also be evaluated.

One major limitation of this study is the design. As previously noted, feedback is an effective and common intervention in OBM. However, variations in feedback may produce only slight differences in performance, and single-subject designs may not be sufficiently sensitive to detect these differences. Only three participants were used, so even if results were not mixed, it would be difficult to make any claims regarding generalization to other populations. Of course, replication is the way external validity is established in single-subject design; future researchers should replicate this study. A design that would not be limited in these ways would be a group design. Using a larger sample and a more sensitive statistical analysis, smaller differences that wouldn't be noticeable via visual

analysis might be identified. A between subjects group design would also have greater external validity.

Of course, group designs also have limitations and drawbacks. One limitation relates to practicality. Depending on the specifics of the design, it may be difficult to acquire the required number of participants needed for each group for adequate statistical analysis. Access to participants as well logistical factors may limit the viability of conducting such a study.

Another limitation and a potential direction for future research is related to the task the participants were asked to complete and the setting in which the study took place. The task completed by participants was a simple analog task that did not change throughout the course of the study. This may limit how well the findings will generalize. In a typical work setting, specific tasks may prove to be more complex than what was requested of the participants in this study. Each participant's history of exposure to various quiz formats and spreadsheets may have also influenced the performance of participants. Aside from experience with the task used in the study, interest in the task may also have been a factor influencing performance. If a participant were to be exposed to interesting tasks, feedback and feedback with social comparison could have acted as a more effective reinforcer. With interesting tasks that have a history of being reinforcing, all levels of performance, including in baseline conditions, would be higher than those found in this study. Finally, the entirety of the study was also conducted remotely. A lack of control over the participants' environment (e.g., most participants completed

sessions from home, which was sometimes chaotic) made it difficult to rule out variables which may have affected participant's performance. The experimenter was unable to remove any potential distractions as well as any other barriers to optimal performance.

In the social validity survey, the length of the study was scored as being unreasonable by two of the three participants. The range of the number of sessions completed was forty-three to forty-eight sessions. This number of sessions, coupled with the consistency of the task and less than frequent compensation, makes the performance potentially unrepresentative of an applied setting. As noted above, future researchers may consider using a group design to decrease the length of time that each participant is in the study.

One of the independent variables of this study was information on group performance. In the current study, it was calculated by averaging the rate of responding from all participants in the test conditions. This information was then simply stated to the participant prior to the start of their next session. This may also not be representative of practical or applied settings. That is, group information may not be offered often or in this medium in the real world. It may also be delivered by peers or a supervisor rather than by an experimenter.

When the current study was first designed, four participants with counterbalanced juxtapositions of condition exposure were proposed. However, towards the end of the study, one participant removed herself from the study. This defeated the purpose of counterbalancing and made it difficult to determine if there

was any influence due to the order in which conditions were provided. This essentially eliminated one dataset in which comparisons between feedback and feedback coupled with social comparison could be made.

Aside from a change of design, future researchers might conduct this study in an applied, as opposed to an analog, setting to better analyze any change in performance due to social comparison. Specifically, the use of employees working in the same department who may share similar tasks might be worthwhile. Incorporating an agent of feedback with whom the participant has a history may alter the value and effectiveness of feedback. In the current study, participants were not given any information on each other nor did they have any history with one another. This may have decreased the effectiveness of receiving group information. Using individuals who share such a history may increase the influence that group information may have on their performance.

Finally, in the current study, researchers looked only at the rate of correct responses. However, there are many different facets in which work can be measured. In certain contexts, simply doing something right versus wrong may not be enough nor relevant. Timeliness of more complex tasks as well as the quality of the work completed are aspects that should be studied in detail. Social comparison may change the context in which feedback is interpreted and thus should be studied in these various contexts

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Appendix

Reyes	630532	630532	Cataract	Procedure	Price
Downs	993123	633015	Appendectomy	Arthroplasty	$14,520
Adkins	514407	668489	Appendectomy	Spinal Fusion	$12,236
Mitchell	996245	675922	Arthroplasty	Hip Replacement	$31,839
Carson	996579	712126	Cataract	Heart Valve	$32,500
Odonnell	907538	744366	Cataract	Fracture	$48,064
Prince	259935	756309	Hip Replacement	PTCA	$28,544
Orozco	229523	757771	Hip Replacement	Hysterectomy	$7,741
Pennington	247079	764782	Appendectomy	Cataract	$6,898
Chambers	478361	764985	Dialysis	Dialysis	$32,750
				Appendectomy	$13,119

Figure 1

Screenshot of one of the questions that was presented to the participant during each session as well as a small portion of each of the three spreadsheet pages that the participant used to respond to the quiz.

1= strongly agree
2= somewhat agree
3= neither agree nor disagree
4= somewhat disagree
5= strongly disagree

Question	Rating
I found this study to take a reasonable length of time.	**1 2 3 4 5**
I enjoyed receiving information on how the group is performing.	**1 2 3 4 5**
I found receiving information on my own performance important.	**1 2 3 4 5**
I feel that knowing how the group was performing improved my own performance.	**1 2 3 4 5**
The information presented to me regarding performance was pertinent.	**1 2 3 4 5**

Did you have a preference regarding receiving no feedback, feedback on your performance alone, or feedback with the group's performance?

Did you experience any adverse effects from receiving feedback or feedback with the group's performance?

Figure 2

The social validity survey presented to participants at the end of the study.

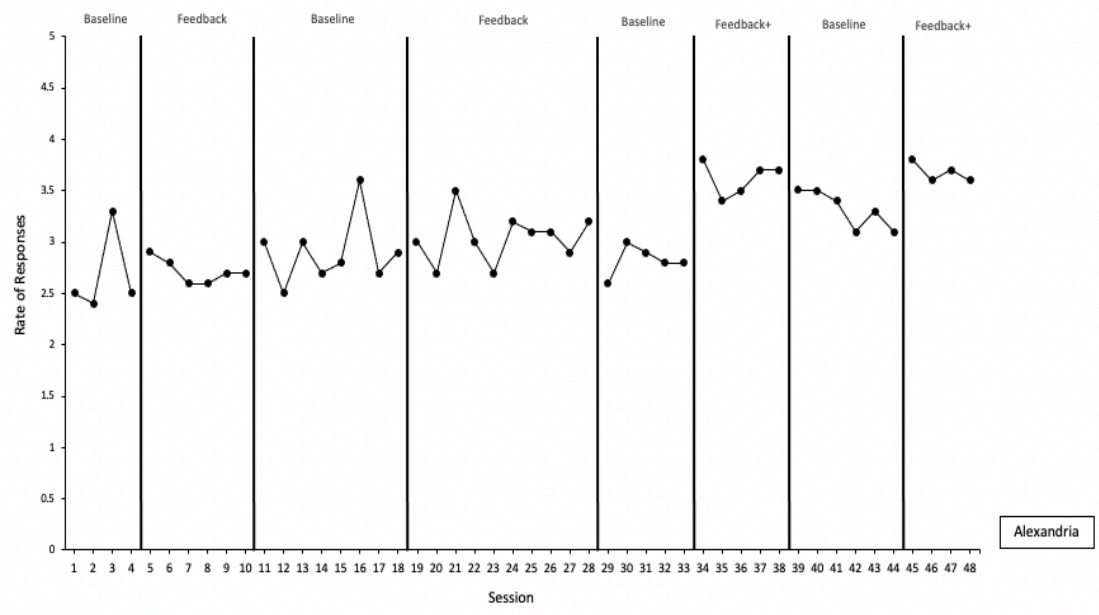

Figure 3

Alexandria's performance across baseline, feedback, and feedback with mean group performance (feedback +).

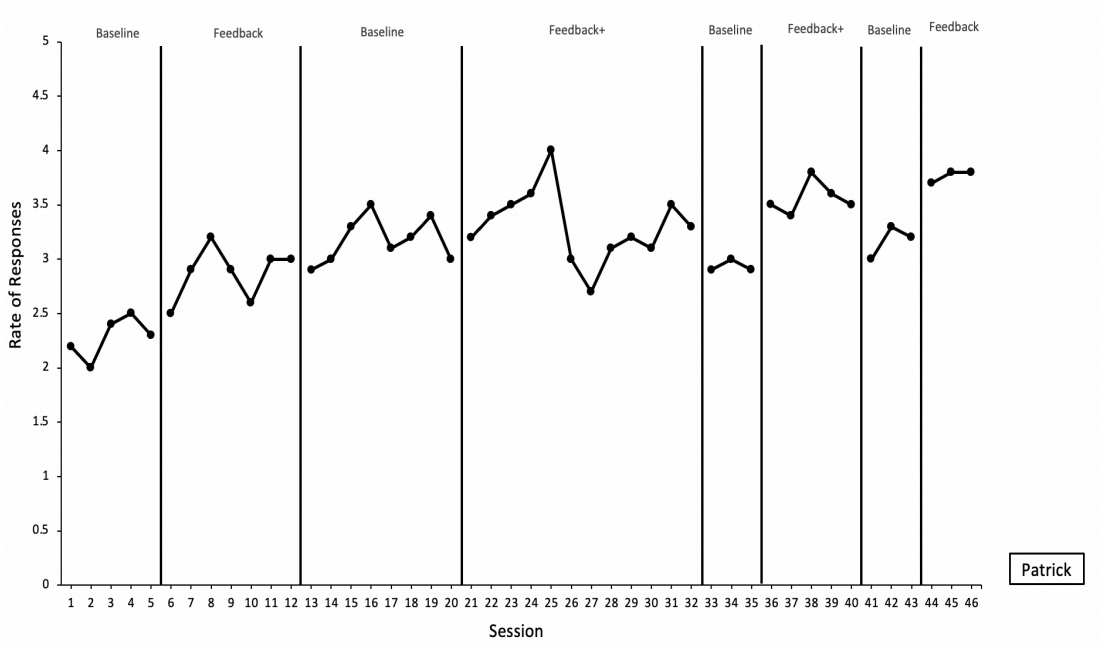

Figure 4

Patrick's performance across baseline, feedback, and feedback with mean group performance (feedback +).

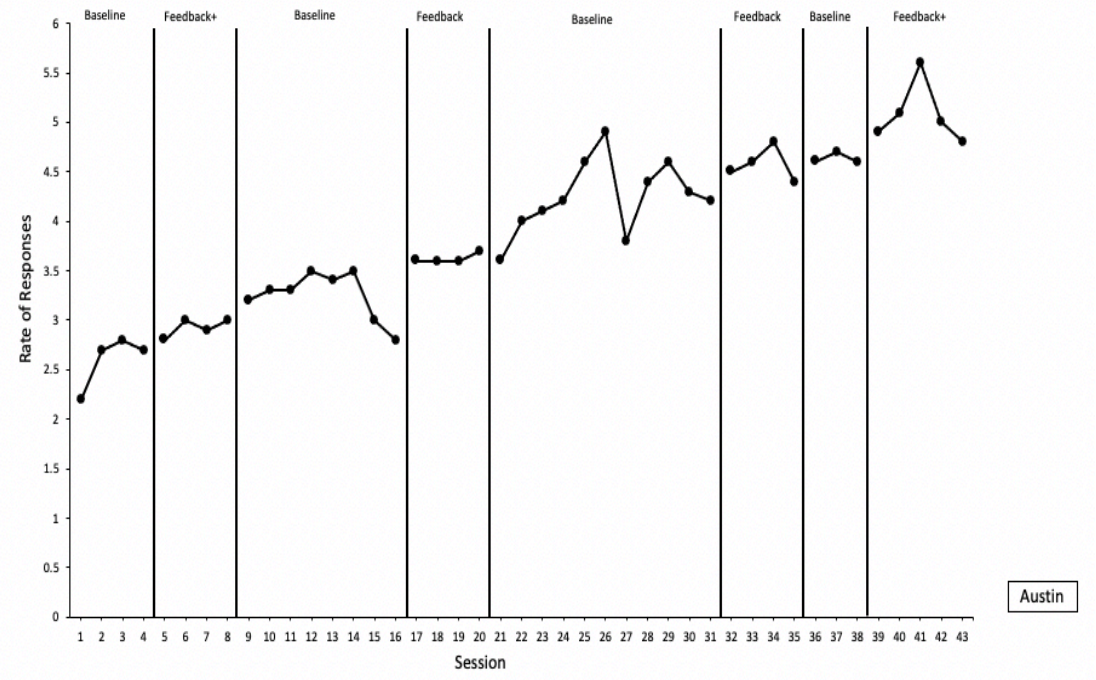

Figure 5

Austin's performance across baseline, feedback, and feedback with mean group performance (feedback +).