YOU MUST BE CREATIVE! THE EFFECT OF PERFORMANCE FEEDBACK ON INTRINSIC MOTIVATION AND CREATIVITY

A Thesis

by

JUSTIN KANE BENZER

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2006

Major Subject: Psychology

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Approved by:

Chair of Committee,	Mindy E. Bergman
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ABSTRACT

You Must Be Creative! The Effect of Performance Feedback on Intrinsic Motivation and Creativity. (December 2006)

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Feedback sign (positive, negative, or no feedback sign) and feedback style (autonomous, controlling, or no feedback style) were manipulated in a 3x3 repeated measures design. Two hundred thirty-three undergraduate students from introductory psychology classes completed measures of perceived competence, perceived choice, and interest over four time periods. Interest was regressed on perceived competence, perceived choice, and a moderation analysis revealed that perceived choice moderated the effect of perceived competence on interest. Creative answers to open-ended problems were assessed after time 2 (before feedback), and after time 3 (after feedback). Feedback style (autonomous, controlled, and neutral) and Feedback sign (positive, negative, and neutral) manipulations were analyzed using a 3x3 ANOVA, revealing no effect of feedback. Post-hoc analyses using perceived difficulty of the first creative problem as a covariate revealed an interaction of feedback style and difficulty, limiting between subjects analyses. Creativity was also regressed on interest. Pre-feedback interest predicted creativity according to expectations, but post-feedback interest did not predict creativity. Creativity did predict post-performance interest, possibly implying

that interest is not a valid proxy for intrinsic motivation in within-subjects designs. Future studies should test the proposition that feedback affects intrinsic motivation, which in turn affects creative performance, and creative performance affects interest.

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CHAPTER I

INTRODUCTION

As competition drives organizations to innovate more rapidly, employee creativity could be the deciding factor that determines the effectiveness and long term survival of an organization (Dess & Pickens, 2000; Tushman & O'Reilly, 1997). Because of this, creativity is becoming increasingly necessary for workers at all levels (Wheatley, Anthony, & Maddox, 1991). Creativity researchers propose that individual employee creativity contributes to overall organizational effectiveness and innovation (e.g., Amabile, Conti, Coon, Lazenby, & Herron, 1996). The current study examines some ways in which performance feedback can impact intrinsic motivation and thereby affect creativity, extending research by Zhou (1998), who demonstrated that how a person evaluates feedback can support or undermine creative production.

The effect of performance feedback on creativity

Zhou (1998) examined the effect of performance feedback on individual creativity. Zhou operationalized performance feedback as either feedback valence or feedback style. Zhou proposed that performance feedback affects intrinsic motivation through perceived competence and self-determination according to cognitive evaluation theory (Deci & Ryan, 1985), and changes to intrinsic motivation would affect creativity. She showed that feedback valence and feedback style had significant main and interactive effects on creativity, but did not verify that the feedback affected the

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This thesis follows the style of the *Journal of Applied Psychology*.

proposed antecedents of intrinsic motivation, perceived competence and self-determination. Furthermore, Zhou operationalized feedback style as either informational (written feedback indicated high or low creativity), or controlling (written feedback indicates what should be done as well as performance). While these dimensions of feedback are consistent with cognitive evaluation theory, it is likely that they are independent dimensions that range across a continuum. The current study focused on the controlling dimension of feedback, proposing a continuous variable that ranges from autonomous to controlling.

Creativity

Creativity defined

Creativity is an essential element of human cognition and not limited to a gifted few (Ward, Smith, & Finke, 1999). The definition of creativity has been the subject of much debate. Researchers have defined creativity in terms of personality (MacKinnon, 1962), problem-solving ability (Cattell, 1971), recognition of ideas (Tyler, 1978), and cognitive processes (Guilford, 1967). A definition of creativity that combines these perspectives is that creativity is an ability to recognize or to generate novel, socially valued products that can be used to solve problems, communicate with others, or entertain ourselves (Franken, 1998; Mumford & Gustafson, 1988).

Creativity consists of a number of elements, including the creative process responsible for generating creative ideas, the characteristics of the individual, and the characteristics of the situation (Mumford & Gustafson, 1988). Over the course of more than fifty years of intense psychological inquiry into the nature of creativity, a great deal

of attention has been given to creative processes (e.g., Guilford, 1956, 1967; Mednick 1962). These creative processes have been used as the basis of creativity assessments. However, although they have been widely used, they have also been highly criticized on the basis of overall predictability, reliability, and discriminant validity (Amabile, 1996, Baer, 1989; Borland, 1986; Heausler & Thompson, 1988; Runco, 1986; Torrance, 1972).

The creative product

Although any psychological assessment is fraught with measurement difficulties, creative processes cannot be reliably measured through self-report because the creativity of a product is determined by social agreement (Mumford & Gustafson, 1988). Amabile (1982) proposed that "a product or response is creative to the extent that appropriate observers independently agree that it is creative. Appropriate observers are those familiar with the domain in which the product was created or the response articulated (p. 1001)." Amabile defined a creative product as one that is both original and appropriate (Amabile, 1982). Original solutions to problems are unusual and are associated with a feeling of surprise, but the solutions must also be appropriate to the problem presented.

Drawing on a variety of social, personality, and cognitive processes, Amabile (1983) proposed three components that drive creativity processes. The first component is composed of creativity-relevant skills (e.g., breaking perceptual set, suspending judgment, reframing familiar problems, and productive forgetting). The second component consists of domain-relevant skills, including factual knowledge, technical skills, and special talents. The final component, and the focus of most of Amabile's

research, is task motivation, which is influenced by attitudes toward tasks and perceptions of the reasons for undertaking tasks.

Intrinsic motivation

Motivation occurs when a person is energized or activated to perform a task. In contrast to theories of operant conditioning, in which behavior is motivated through the expected extrinsic outcomes, intrinsic motivation theories suggest that it is the process of engaging in an act that is enjoyable. Thus, intrinsic motivation can be defined as the force driving the performance of an activity based on the intrinsic satisfaction gained from a task rather than external pressures or rewards (Deci & Ryan, 2000).

Although intrinsic and extrinsic motivation both increase the frequency and intensity of behavior, they operate very differently. Extrinsic motivation drives a person toward a goal by the interaction of the properties of an external reward and the needs of the person. Intrinsic motivation, in contrast, drives a person toward a goal based on the interaction between the properties of the task (rather than the reward) and the interests of the person (White, 1959). In extrinsic motivation, the role of the task in satisfying personal needs is secondary; a person might stop performing a task if an easier alternative to gaining the reward or satisfying the need is found.

Although intuitively pleasing, the idea that intrinsic and extrinsic motivators could additively increase behavior is not supported by research. Deci (1971) published the first study investigating how extrinsic rewards interacted with intrinsic motivation, showing that the presentation of an extrinsic reward for an intrinsically interesting task decreased intrinsic motivation. This effect has been replicated in many other studies

(e.g., Lepper & Greene, 1978; Notz, 1975). According to cognitive evaluation theory (Deci & Ryan, 1985), this effect occurs because rewards shift the internal locus of causality from internal to external. In other words, when presented with a reward, people enact behavior in order to attain the reward, making the reward the cause of their behavior, rather than intrinsic enjoyment of the activity.

Intrinsic motivation is a component of the creative process

Extending research on the effect of reward on performance (Deci, 1971), Amabile showed that external evaluation (1979) decreases intrinsic motivation and creativity. Amabile further demonstrated that reward, independent of expected evaluation, has a similar effect on intrinsic motivation and creativity (Amabile, Hennessey, & Grossman, 1986).

Hypothesis 1: Intrinsic motivation will have a positive, linear, main effect on creative performance.

Cognitive evaluation theory

Intrinsic motivation is thought to emerge when opportunities to express interest or curiosity appear, but this motivation can be affected by aspects of the environment. Cognitive evaluation theory describes how environmental effects can undermine intrinsic motivation (Deci & Ryan, 1985).

Environments that influence intrinsic motivation can have informational, controlling, and amotivating dimensions (Deci & Ryan, 1985). The informational

dimension is defined by information that can improve a person's ability to interact with the environment. It is characterized by a state where people perceive a choice of behavior where they do not feel pressured toward attaining a specific outcome. The controlling dimension conveys a message indicating that a behavior is being controlled by an external force. It is experienced as pressure to behave in a certain way, and is characterized by a situation that makes a behavior instrumental for attaining a desired outcome. For example, people may experience external controls in a work situation when a supervisor demands a specific behavior. The amotivating dimension describes aspects of the environment that decrease a perceived inability to master a situation, leading to a perception that the situation is entirely outside of a person's control. Amotivated perceptions can be characterized by a lack of perceived competence, and over time can result in decreased self-determination leading to a feeling of helplessness. [1]

Deci and Ryan (1985) asserted that individuals' reactions to the informational and controlling aspects of the environment can affect both self-determination and perceived competence, which in turn affect intrinsic motivation.

Self-determination

Self-determination is characterized by the perception of choice. As long as individuals perceive that they have a choice of action, their behavior will be self-

[1] Amotivated states are thought to be the result of long-term indications of incompetence. As the present study focuses on short-term events, the amotivational state was not considered.

determined. A behavior can be defined as chosen only if the person could seriously consider not performing the behavior (Deci & Ryan, 1985). Information suggesting autonomous control over the task can increase self-determination by promoting an internal perceived locus of causality. Perceived locus of causality indicates whether people feel that they are the initiators of their behavior or if they feel that the initiation of their behavior is controlled by an outside force (deCharms, 1968; Rotter, 1966).

Low self-determination of behavior can also be thought of as controlled, either in the environment or internally (e.g., to maintain self-esteem), rather than being regulated by choices. Controlled behavior is characterized by tension and is less flexible than self-determined behavior. People experience controlling events as pressure to think, act, or behave in certain ways. Controlling aspects of the environment convey a message indicating that initiation of the behavior is being controlled by an external force, causing a change to an external perceived locus of causality which limits choices of action (Deci & Ryan, 1985). For example, external rewards increase the perceived value of behaviors associated with attaining the reward, causing pressure to perform those behaviors and limiting choice of action. Thus the reward will cause a change from an internal locus of causality to an external locus of causality decreasing intrinsic motivation.

Hypothesis 2: Self-determination will have a positive, linear main effect on intrinsic motivation.

Perceived competence

Perceived competence is the individual's perceived ability to successfully accomplish a task. The feeling of competence at a task is thought to generate positive affect that provides part of the motivational energy driving intrinsically motivated behavior. Perceived competence may or may not be different from self-efficacy. As the relationship between these constructs has not been fully explored, the present paper will use perceived competence in order to remain consistent with self-determination theory. Perceived competence can be increased or decreased based on information about ability or performance.

Perceived competence is predicted to affect intrinsic motivation if the behavior is self-determined and if the task is challenging (Deci & Ryan, 1985). This is because Deci and Ryan (1985) proposed that self-determination is a requirement of intrinsic motivation; behavior that is not self-determined will not be intrinsically motivated. Therefore the effect of perceived competence on intrinsic motivation will be dependent on perceptions of self-determination (see Figure 1).

Hypothesis 3: Self-determination will moderate the effect of perceived competence on intrinsic motivation such that perceived competence will have no effect on intrinsic motivation when self-determination is low, but increases in perceived competence will have positive effects on intrinsic motivation when self-determination is high.

Feedback

Feedback is a form of communication in which the message sender is attempting to provide information about some aspect of an event to the message recipient. Reactions to feedback depend on the personal characteristics of the recipient, the nature of the message, and the characteristics of the source. The effect of feedback on extrinsically motivated behavior is based on whether or not the feedback recipient, source, and message interact in a way that reinforces the desired behavior (Ilgen, Fisher & Taylor, 1979). In an extrinsically motivated situation such as work, feedback can be thought of as a primary reinforcer linked to a secondary reinforcer, which is usually some form of (monetary) reward. Deci (1975) theorized that feedback can potentially produce similar effects as reward on intrinsic motivation. Intrinsically motivated behavior cannot be extrinsically reinforced, and so the effect of feedback (or any reward) on intrinsic motivation must be evaluated from a cognitive evaluation perspective, using the dimensions of information, control, and amotivation (Deci & Ryan, 1985). Deci and Ryan (1985) also stated that permissive environments, which are characterized by a lack

of structure and can be compared to neglect, will result in much lower intrinsic motivation than any other conditions.

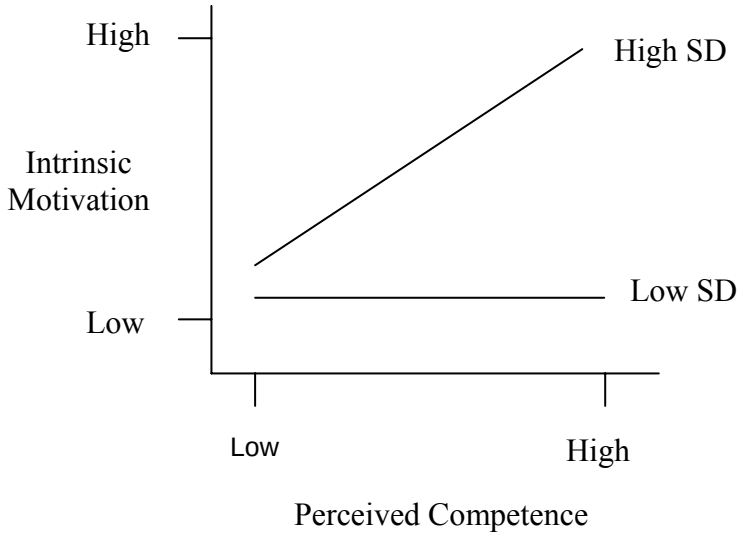

Figure 1. The Moderating Effect of Self-Determination (SD) on the Effect of Perceived Competence on Intrinsic Motivation.

Little research had examined the effects of feedback on creativity before Zhou (1998). Most of the earlier studies that examined feedback and either creativity or intrinsic motivation focused on positive feedback exclusively (e.g., Carson & Carson, 1993; Fodor & Greenier, 1995; Harackiewicz, Abrahams, & Wageman, 1987). Zhou (1998) demonstrated that feedback affects creativity through two avenues: the presentation style (i.e., how the feedback is phrased), and the sign or valence of the feedback. These two components of feedback will be investigated in this study (see Figure 2).

Feedback style

According to cognitive evaluation theory, different characteristics of feedback (style) have the potential to affect people along informational, controlling, and amotivating dimensions. Zhou (1998) manipulated the informational component by adding short phrases (e.g., You did really well. Congratulations! Keep up the good work.) supporting the numerical feedback sign given. The current study does not manipulate the informational or amotivating component of feedback, instead it focuses on the controlling component.

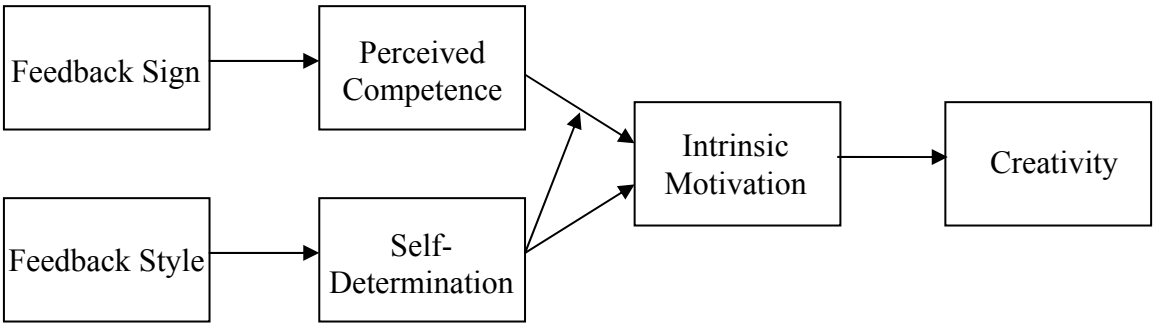

Figure 2. Proposed Effects of Feedback Sign and Feedback Style on Perceived Competence, Self-Determination, Intrinsic Motivation, and Creativity.

The style in which feedback is presented can be interpreted as emphasizing either autonomy or control (Deci & Ryan, 1985; Zhou, 1998). While feedback style can to some degree be subjectively interpreted by the feedback recipient, previous research has identified feedback elements that emphasize control (Ryan, 1982). Controlling feedback

can be perceived as forcing individuals into certain behaviors, preventing choice and decreasing self-determination (Deci & Ryan, 1985). Controlling feedback style is characterized by what a person "must" or "should" do, thereby limiting behavioral alternatives (Zhou, 1998). Controlling feedback increases the salience of external constraints, stressing external demands on performance. In contrast, feedback style that tends to be interpreted as autonomous should increase behavioral alternatives (Deci & Ryan, 1985). Autonomous feedback can be characterized by choice of behavior, or what a person "can choose to do" rather than what a person "should" do (Zhou, 1998). The current study manipulates controlling feedback style along a dimension from high (controlling feedback) to low (autonomous feedback).

> *Hypothesis 4:* Feedback style will have a main effect on self-determination such that feedback presented in a more autonomous style will increase self-determination, whereas feedback presented in a controlling style will decrease self-determination.

This argument of the effect of feedback style on intrinsic motivation is predicated on changes in self-determination. Autonomous style is predicted to increase self-determination whereas controlling style is predicted to decrease self-determination. Thus, self-determination is the intervening process between feedback style and intrinsic motivation, driving changes in intrinsic motivation following feedback.

Hypothesis 5: Self-determination will mediate the effect of feedback style on intrinsic motivation.

Feedback sign

In their meta-analysis, Kluger and DeNisi (1996) demonstrated that a person's behavior changes as a result of comparisons of the feedback message to goals or standards within the context of the task. This comparison results in a positive or negative evaluation of performance relative to the standard (feedback sign). Kluger and DeNisi (1996) asserted that the evaluation of feedback is a complicated process in which both positive and negative feedback can result in either increased or decreased effort . It is important to recognize, however, that all feedback intervention theories reviewed by Kluger and DeNisi were extrinsically based, limiting applicability of their findings to intrinsically motivated situations. In cognitive evaluation theory, the sign of the feedback can be interpreted as providing information that either increases or decreases perceived competence. Perceived competence is thought to increase intrinsic motivation when self-determination is high (Deci & Ryan, 1985).

Hypothesis 6: Feedback sign will have a positive, linear main effect on perceived competence.

Hypothesis 7: Perceived competence will mediate the effect of feedback sign on intrinsic motivation.

Intrinsic motivation as a mediator of feedback and creativity

Zhou (1998) attempted to link creative performance, feedback, autonomy, and intrinsic motivation using self-determination theory (Deci & Ryan, 1980). Although she demonstrated that feedback style and feedback sign have an interactive effect on creative performance, she did not examine how intrinsic motivation mediates the process. Although some later studies did examine the mediating role of intrinsic motivation, results have been mixed, showing either partial or no mediation (Shalley & Perry-Smith, 2001; Shin & Zhou, 2003). The mediating role of intrinsic motivation between environmental influences (e.g., reward, feedback, evaluation expectation) and creativity is central to creativity research. Zhou (1998) proposed that cognitive evaluation theory would explain the effects of performance feedback on creativity because feedback is thought to affect creativity through the mediation of intrinsic motivation. If intrinsic motivation does not mediate the effects of performance feedback on creativity, then current conceptions of creativity may need to be revised. The current study will examine only the mediation of intrinsic motivation on the effect of feedback sign on creativity because the main effect is more thoroughly documented in the literature.

Hypothesis 8: Intrinsic motivation will mediate the effect of feedback sign on creativity.

CHAPTER II

METHOD

Design

The independent variables of feedback sign and feedback style were manipulated in a laboratory experiment with a 3 (positive, negative, or no feedback sign) x 3 (autonomous, controlling, or no feedback style) x 4 (baseline, post-task 1, after feedback, post-task 2) repeated measures design.

Participants

Two hundred thirty-three undergraduate students from introductory psychology classes at a large southwestern university participated in this study in exchange for credit toward their course's research requirement. Participant's ranged from 17-28 years old (=18.74, SD=1.22), but the majority of participants were either 18 (*N* =113) or 19 (*N*=80). One hundred-five participants were male, 128 were female.

Participants were randomly assigned into one of the nine experimental conditions, positive sign/no feedback style (*N*=25), negative/no feedback style (*N*=25), no feedback sign/autonomous style (*N*=26), no feedback sign/controlling style (*N*=25), positive feedback sign/autonomous style (*N*=25), positive feedback sign/controlling style (*N*=25), negative feedback sign/autonomous style (*N*=26), negative feedback sign/controlling style (*N*=27), or no feedback (*N*=26).

Procedure

All data were collected via a web-based computer program specifically designed for this study. Participants individually completed the experiment in groups of up to 20.

Participants were randomly assigned to computer workstations that were loaded with a computer program that presented the cognitive evaluation theory (CET) assessments and creative tasks. The experiment lasted one hour.

The experiment had two sections (before and after feedback). In the first section, participants indicated their age, sex, and self-reported creativity. Participants were then instructed to imagine themselves as the head of a campus community service group, responsible for recruiting new members, resolving conflicts, and planning activities. They were informed that they needed to solve several problems in as many creative ways as they could. They also were informed that previous participants usually spent around five minutes on each problem, but they could spend more or less time as they needed. After these initial instructions, participants completed the Time 1 CET assessment measuring perceived competence, self-determination, and intrinsic motivation regarding the upcoming task. Participants then completed Task 1, one of two open-ended creative problems adapted from Shalley (1995), counterbalanced to avoid order effects (see Appendix A).

After Task 1, participants completed Time 2 CET assessments as well as a big five personality assessment as a filler task for approximately 15 minutes. Participants in feedback conditions were informed via the web interface that judges were scoring their creativity on the earlier problems during this time (a deception). There were no manipulation checks given to participants to verify the effectiveness of the manipulations. After participants finished their filler task, the web program instructed them to raise their hand and wait for the experiment proctor to get their creativity score

report, which included their creativity feedback. Participants were randomly assigned to feedback condition, with the exception of the no-feedback condition (no feedback sign, no feedback style). No-feedback participants were not mixed in with participants in the other conditions so they would not be affected by others' actions. Participants in the no-feedback condition did not receive the deception about the judges.

Following feedback, the second section of the experiment began. All participants completed Time 3 CET assessment followed by the Task 2 creative problem. Following Task 2, all participants completed Time 4 CET assessment and received their debriefing.

Manipulations

Both feedback style and feedback sign were manipulated with a feedback sheet adapted from Zhou (1998), which participants in feedback conditions received after the first set of exercises.

Feedback sign

Participants were assigned ratings from a range of creativity scores (10 point scale) in four categories that were supposedly obtained from a pretest of 400 students from the same university. In addition, participants received handwritten comments which corresponded to their feedback condition. Participants in the positive feedback condition were given ratings between 8 and 10 and the comment "Congratulations! Your answers so far have been really creative." Participants in the negative feedback condition were given ratings between 1 and 3 and the comment "I'm sorry, your answers were not very creative." Ratings between 4 and 7 were not used. All sign feedback was a deception, as no ratings occurred during the experiment.

Feedback style

Feedback style was manipulated by putting different comments on the feedback sheet. Comments were intended to be either autonomous or controlling. Autonomous feedback was intended to provide information without restricting autonomy. Following instructions by Ryan (1982), Zhou (1998) focused on words such as “should” to increase feelings of control.

Participants in the autonomous feedback condition received the comment "Creativity is a trait common to all people, but many people do not choose to use it. If you choose to act creatively, your next set of answers will no doubt be creative." For the controlling feedback condition, participants received the comment, "Creative ability is limited to a gifted few. You have to try as hard as you can on the next set of exercises. You should answer as creatively as you can. It is extremely important that you answer as creatively as possible or we won't be able to use your answers."

Measures

Creativity

The creativity of the participants’ solutions were assessed using the consensual assessment technique developed by Amabile (1979, 1982). According to guidelines specified by Amabile (1982), judges independently evaluated, on a 10 point scale ranging from 1 (lowest) to 10 (highest), the creativity of each of the solutions. In addition, the judges rated the creative aspects of originality and appropriateness. Originality was measured with a 5 point scale (1 = not at all original, 5 = extremely

original). Appropriateness was measured with a 5 point scale (1 = the answer will definitely not solve the problem, or is not related to the problem, 5 = the answer will almost definitely solve the problem). Judges also rated the technical aspects of each of the solutions. The technical aspects were length, grammar, spelling, clarity, amount of detail, and effort evident. Because the judges were not experts in grammar, standard 5 point Likert-type scales were not used. Instead, scales were constructed with fixed anchors at each level. The number of points in each scale was determined by the clarity of differentiation between anchors. Anchors for technical aspects are given in Appendix B.

Undergraduate research assistants were used as creativity judges. The order of ratings for each judge was arranged randomly by the experimenter so that each judge always rated in the same order, but the order differed across judges. Each judge was instructed to rate all dimensions for one solution before moving on to the next solution. The judges were instructed to rate the creativity of each solution relative to the other solutions and not against some absolute standard. To improve their ability to rate in this way, the judges were instructed to rate fifty answers from a pilot experimental task not used in the experiment prior to rating in order to give them a general sense of the variability of creative responses.

Twenty percent of the creative solutions were rated by every judge to determine inter-rater reliability. The judges' ratings were factor analyzed to determine if the six aspects of the solutions do form the two dimensions of technical goodness and creativity in order to establish discriminant validity.

Participants were allowed to provide as many solutions to the creative tasks as they chose. The number of solutions per task varied between 1 and 13. Maximum creativity scores were created from the highest creativity rating on a single task. Mean creativity scores were also constructed based on the average creativity rating for each task.

Task difficulty

Participants reported the perceived difficulty of each of the two creative tasks. Participants were categorized into low ($N = 114$) and high ($N = 117$) difficulty groups. The low group reported the difficulty of their first creative task as 1, 2, or 3. The high group reported 4 or 5, and two participants did not report the difficulty of their first creative task. Although difficulty ratings were recorded for both tasks, difficulty groups were based on the difficulty of the first task, because only the first task difficulty would affect the evaluation of feedback. Perceived task difficulty did decrease from task 2 to task 1, $t(226) = 2.07$, $p < .05$, $d = .16$.

Cognitive evaluation theory assessments

Perceived competence (e.g., "I think I am pretty good at this activity"), self-determination (e.g., "I believe I had some choice about doing this activity"), and intrinsic motivation (e.g., "I think this activity is fun") were measured with a seven item scale with a seven point format (1, "strongly disagree"; 7, "strongly agree") (Deci & Ryan, 2005). All CET assessments were measured at Time 1, Time 2, Time 3, and Time 4. Time 1 refers to the first set CET assessments that precede Creative Task 1. Time 2 refers to the second set of CET assessments measured after Creative Task 1 but before

feedback. Time 3 CET assessments were measured after feedback and before Creative Task 2. Time 4 CET assessments were measured after Creative Task 2. Reliabilities of all scales at all time periods are reported in Table 1, and inter-correlations are reported in Table 2.

Control variables

Previous research has shown sex differences in reactions to instructions of "be creative" (Katz & Poag, 1979). When confronted with ambiguous situations, women were found to be more likely to respond in a verbal manner, which would be particularly appropriate for this study. Men, in contrast, improved their verbal scores only when presented the instructions of "be creative" in a verbal task. For this reason, females may have higher creative responses. Thus, sex was included as a control variable. Self-rated creativity should reflect actual creative ability and was controlled. A computer error prevented recording of cognitive ability (SAT scores). Finally, age was controlled because experience will increase with age, and may affect creative responses.

Table 1

Coefficient Alphas for Intrinsic Motivation, Perceived Competence, and Self-Determination for Each Time Period

Scale	Time 1	Time 2	Time 3	Time 4
Intrinsic Motivation	.68	.82	.86	.83
Perceived Competence	.72	.89	.87	.89
Self-Determination	.85	.92	.94	.92

Table 2

Inter-correlations for Intrinsic Motivation, Perceived Competence, and Self-Determination across Each Time Period

Scale	Time 2	Time 3	Time 4
Intrinsic Motivation Time1	.60	.56	.42
Intrinsic Motivation Time 2		.76	.58
Intrinsic Motivation Time 3			.65
Self-Determination Time 1	.67	.64	.64
Self-Determination Time 2		.85	.82
Self-Determination Time 3			.87
Perceived Competence Time 1	.30	.32	.33
Perceived Competence Time 2		.66	.41
Perceived Competence Time 3			.51

CHAPTER III

RESULTS

Creativity inter-rater reliability

Six judges each rated a set of 414 creative problem solutions which represented approximately 20% of the solutions rated. The solutions were rated on dimensions of creativity, originality, appropriateness, clarity, detail, effort, grammar, length, and spelling. Cronbach's alpha was calculated to determine inter-rater reliability by transposing the data so that raters became items and ratings were cases, and so was used and interpreted here as an intraclass correlation (Creativity = .75, Originality = .79, Appropriateness = .74, Clarity = .53, Detail = .86, Effort = .79, Grammar = .72, Length = .94, Spelling = .87). All ratings showed high inter-rater reliability with the exception of clarity, which was not used in any analyses. The purpose of the factor analysis was primarily to determine that creativity, originality, and appropriateness formed one factor and were independent of other dimensions. The dimensions were factor analyzed using principal axis with a varimax rotation to ensure orthogonal factors. As no published research has examined these factors before, exploratory factor analysis was used. Creativity, appropriateness, and originality loaded on factor 1. Detail and length loaded on factor 2. Effort loaded equally on factor 1 and 2. Clarity and grammar loaded on factor 3, and spelling did not load heavily on any factor. This showed that the creativity dimensions were independent of all other dimensions except for effort. Covariance between the orthogonal factors was low for factor 1 and factor 2 (.12/.09 without effort), factor 1 and factor 3 (.07/.06), and factor 2 and factor 3 (.06/.04)

A promax rotation revealed that effort loaded on factor 2 using non-orthogonal factors. Factor loadings are reported in Table 3.

Table 3

Factor Analysis of Creativity Dimensions

	Varimax Rotation			Promax Rotation		
Dimension	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Creativity	.80*	.16	-.00	.89*	-.05	-.14
Originality	.75*	.17	.12	.80*	-.03	.00
Appropriateness	.65*	.18	.25	.63*	.02	.15
Clarity	.20	-.16	.82*	.08	-.20	.82*
Detail	.37	.55*	.34	.12	.58*	.17
Effort	.57*	.56*	.19	.39	.53*	-.04
Grammar	.04	.20	.40*	-.15	.24	.40*
Length	.23	.67*	.28	-.08	.78*	.07
Spelling	-.01	-.07	.02	.01	-.09	.06

**Factor loading meets or exceeds .40*

Effect of feedback sign and feedback style on creativity

A 3 (feedback sign) x 3 (feedback style) ANOVA was performed to examine the effects of the experimental manipulation on creativity. Feedback effects were not

expected for Task 1 creativity because feedback had not been presented. Unexpectedly, a significant effect for feedback style was observed ($F(2, 224) = 3.04$, $p < .05$, partial η^2=.03). Experimental session (i.e., time period of data collection) also was found to have a significant effect on Task 1 max creativity ($F(23, 209) = 6.51$, $p < .05$, partial η^2=.42), and significantly decreased the effect of feedback style on Task 1 creativity ($F(2, 223) = 0.10$, $p > .05$, partial η^2<.01). Creativity scores for each the experimental conditions are presented in Tables 4 and 5.

A 3 (Feedback Sign) x 3 (Feedback Style) ANCOVA, controlling for Time 1 creativity revealed no effect for mean creativity, and a main effect for feedback style on maximum creativity ($F(2, 223) = 4.12$, $p < .05$, partial η^2=.04). It seems likely that reactions to feedback style will depend on the perceived difficulty of the first creative task. The feedback style manipulations began with the controlling phrase "Creativity is limited to a gifted few," or the autonomous phrase "Creativity is common to all people." Participants who thought the difficulty was low and received controlling feedback might feel autonomous because they are the "gifted few." Similarly, participants who were told that creativity is common to all people might feel controlled if they thought the task was hard. Therefore, analyses were repeated with Task 1 difficulty (2 levels) added as a random factor. Difficulty was shown to interact with feedback sign ($F(2, 4) = 16.39$, $p < .01$, partial η^2=.89), and feedback style ($F(2, 5) = 7.99$, $p < .05$, partial η^2=.78) to determine Task 2 maximum creativity. Difficulty interacted with feedback sign ($F(2, 4) = 7.99$, $p < .05$, partial η^2=.84) to determine Task 2 mean creativity and had a non-significant interaction with feedback style ($F(2, 4) = 4.56$, $p < .10$).

Table 4

Mean Creativity Scores for the Nine Experimental Conditions

	N	Mean 1	Mean 2	Max 1	Max 2
No Sign/Autonomous	27	3.95 (1.12)	4.07 (0.98)	6.00 (1.69)	6.37 (1.80)
No Sign/Controlling	25	3.98 (0.86)	4.26 (1.18)	6.44 (2.00)	6.96 (2.26)
Positive/No Style	26	3.58 (1.13)	4.01 (1.09)	5.27 (2.01)	5.62 (1.63)
Negative/No Style	25	4.00 (0.76)	3.94 (1.36)	5.52 (1.26)	5.68 (2.16)
Positive/Autonomous	25	4.38 (1.35)	4.67 (1.26)	6.36 (1.91)	6.40 (1.71)
Negative/Autonomous	27	4.52 (1.16)	4.67 (1.26)	6.41 (1.62)	6.44 (1.72)
Positive/Controlling	26	3.78 (1.07)	3.94 (1.36)	5.81 (2.17)	6.46 (2.18)
Negative/Controlling	26	4.73 (1.28)	4.60 (1.51)	6.27 (1.76)	6.69 (2.00)
Neutral (No Feedback)	26	4.39 (1.38)	3.99 (1.52)	6.00 (1.72)	5.46 (2.40)
Overall	206	4.15 (1.18)	4.19 (1.27)	6.01 (1.84)	6.34 (1.95)

Note. Standard deviations in parentheses.

Table 5

Mean Creativity Scores for Feedback Sign and Feedback Style

	N	Mean 1	Mean 2	Max 1	Max 2
Positive	77	3.90 (1.22)	4.05 (1.22)	5.81 (2.06)	6.16 (1.87)
Negative	78	4.42 (1.34)	4.41 (1.34)	6.08 (1.59)	6.28 (1.98)
No Sign[a]	52	3.96 (0.99)	4.16 (1.07)	6.21 (1.84)	6.65 (2.04)
No Style[a]	51	3.79 (0.98)	3.97 (1.12)	5.39 (1.67)	5.65 (1.89)
Autonomous	79	4.30 (1.23)	4.32 (1.18)	6.25 (1.73)	6.41 (1.72)
Controlling	77	4.15 (1.14)	4.27 (1.37)	6.17 (1.98)	6.70 (2.13)
Overall[a]	206	4.12 (1.15)	4.22 (1.24)	6.01 (1.84)	6.33 (1.95)

Note. Standard deviations in parentheses.

[a] Means do not include neutral group

Graphs of the interactions (see Figures 3-6) revealed that negative feedback resulted in higher mean creativity as difficulty increased, while positive feedback resulted in decreased mean creativity, indicating that positive feedback results in lower performance in high difficulty situations, while negative feedback seems to present a challenge to participants. As predicted, controlling feedback resulted in decreased creativity as difficulty increased, while autonomous feedback resulted in slightly increased creativity. Maximum creativity was not affected by either feedback sign or feedback style. Zhou (1998) did not measure maximum creativity, so it is possible that

feedback does not affect verbal maximum creativity, although lack of feedback did negatively affect maximum creativity.

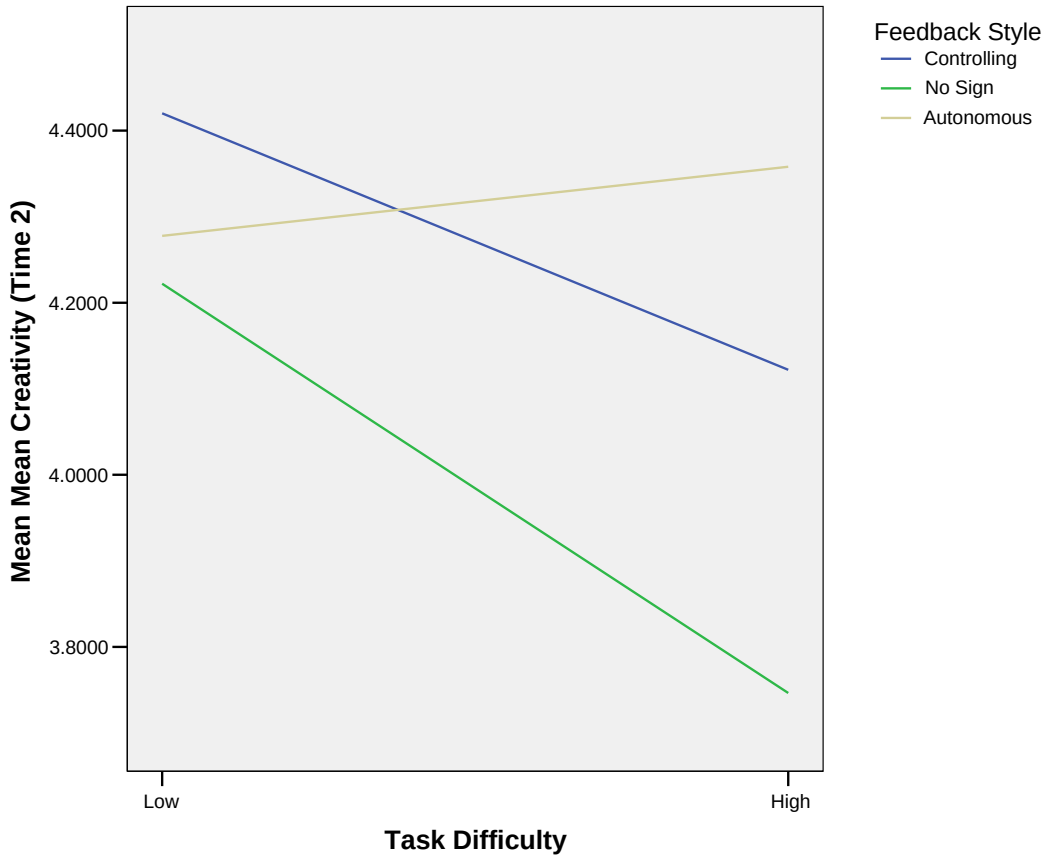

Figure 3. Interaction of Task Difficulty and Feedback Style on Max Creativity.

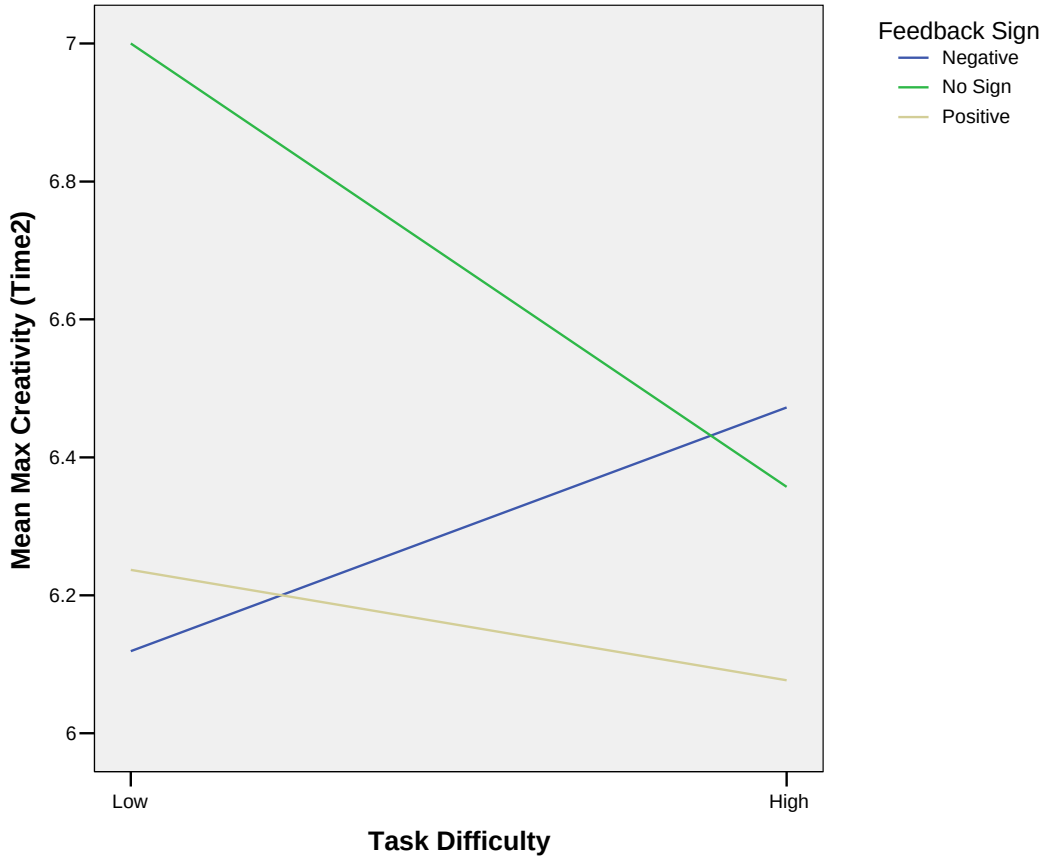

Figure 4. Interaction of Task Difficulty and Feedback Sign on Max Creativity.

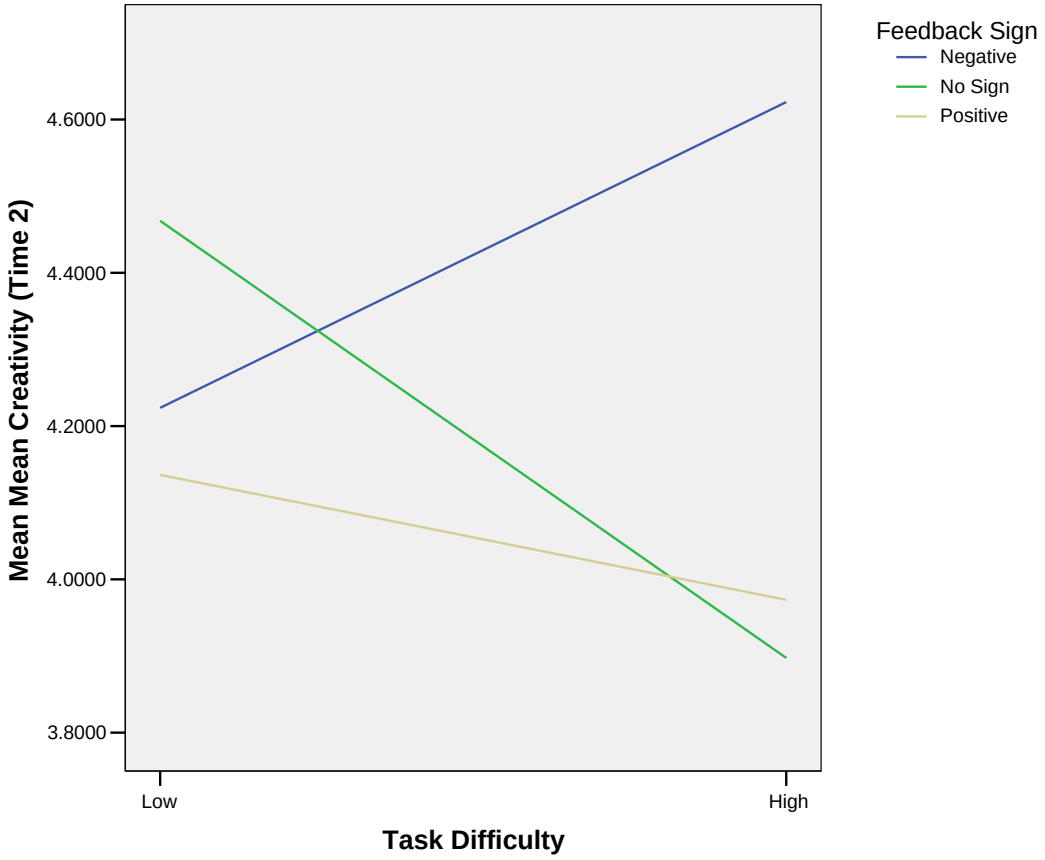

Figure 5. Interaction of Task Difficulty and Feedback Sign on Mean Creativity.

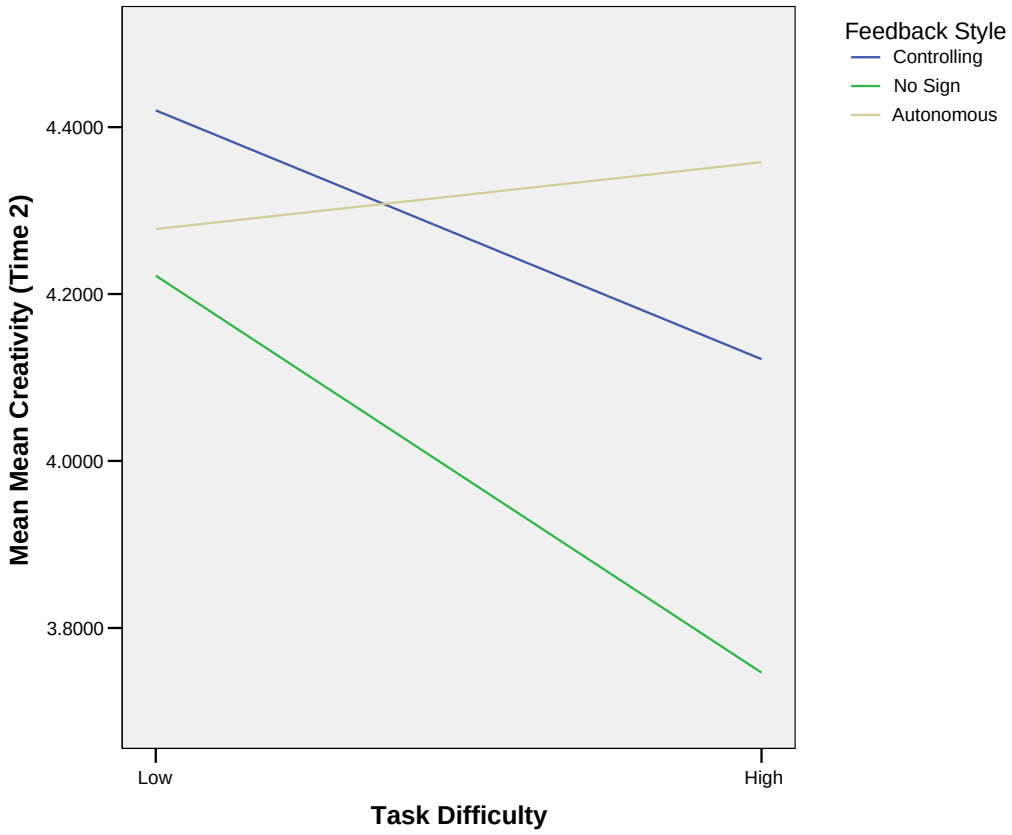

Figure 6. Interaction of Task Difficulty and Feedback Style on Mean Creativity.

Further analysis of the graphs indicated that the interaction of task difficulty and feedback sign on mean creativity was due to the interaction of positive and no feedback sign conditions. As the neutral condition should act as a neglectful environment resulting in lower intrinsic motivation over time, it may not be useful as a control group. Examination of intrinsic motivation scores over time supports this effect (see Table 6 and Figure 7). Repeating analyses without the neutral condition revealed a non-significant interaction between task difficulty and feedback sign on Task 2 maximum

creativity ($F(3, 2) = 6.06$, $p < .10$). All future analyses were performed with and without the neutral condition, and significant differences were noted.

Table 6

Mean Intrinsic Motivation Scores for Nine Experimental Conditions

Feedback Sign	*N*	IM 1	IM 2	IM 3	IM 4
No Sign/Autonomous	27	3.43 (.61)	3.07 (.76)	3.19 (.68)	3.46 (.80)
No Sign/Controlling	25	3.47 (.50)	3.09 (.81)	3.13 (.72)	3.14 (.58)
Positive/No Style	26	3.48 (.56)	3.16 (.58)	3.29 (.62)	3.35 (.68)
Negative/No Style	25	3.35 (.50)	2.97 (.75)	2.76 (.80)	2.91 (.68)
Positive/Autonomous	25	3.36 (.61)	3.18 (.71)	3.34 (.71)	3.20 (.70)
Positive/Controlling	26	3.38 (.46)	3.01 (.55)	3.10 (.62)	3.32 (.69)
Negative/Autonomous	27	3.39 (.55)	3.24 (.61)	3.01 (.62)	3.25 (.69)
Negative/Controlling	26	3.37 (.56)	3.15 (.72)	2.87 (.82)	3.29 (.76)
Neutral (No Feedback)	26	3.46 (.58)	3.05 (.86)	2.96 (.85)	2.94 (.84)
Overall[a]	207	3.41 (.54)	3.11 (.68)	3.09 (.71)	3.24 (.71)

Note. Standard deviations in parentheses.

[a] *Means do not include neutral group*

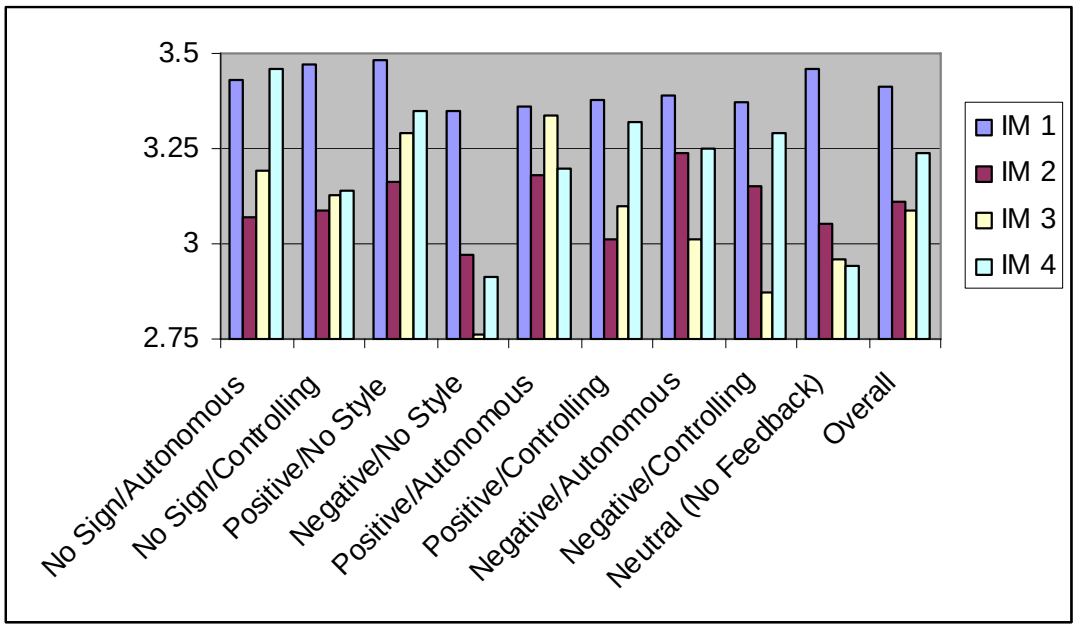

Figure 7. Mean Intrinsic Motivation (IM) Scores for Nine Experimental Conditions.

Hypothesis 1

Hypothesis 1 stated that intrinsic motivation (IM) will have a positive, linear main effect on creative performance (see Table 7). To test this hypothesis, Task 1 creativity was first regressed on Time 1 intrinsic motivation (IM 1) controlling for sex, age, and creativity skill. IM 1 predicted Task 1 maximum and mean creativity. Task 1 creativity (both maximum and mean) predicted IM 2 which suggests that self-evaluated performance influenced later intrinsic motivation.

Task 2 creativity was then regressed on Time 2 intrinsic motivation (IM 2) for all conditions and also in the neutral condition alone. Contrary to expectations, IM 2 predicted maximum and mean Task 2 creativity, while the neutral condition did not.

The Time 1 relationship supported Hypothesis 1. The effect for Time 2 was contrary to expectations in the thesis proposal; IM 2 should not have predicted Task 2 creativity, due to the effect of feedback on creativity.

Table 7

The Relationship between Intrinsic Motivation and Creativity

	β	ΔR^2	ΔF
Effect of IM 1 on Time 1 max creativity	.21	.02	8.26**
Effect of IM 1 on Time 1 mean creativity	.15	.02	4.14*
Effect of Time 1 max creativity on IM2	.23	.05	13.50**
Effect of Time 1 mean creativity on IM2	.23	.05	12.78**
Effect of IM2 on Time 2 max creativity	.17	.03	6.13**
Effect of IM2 on Time 2 mean creativity	.18	.03	6.77**
Effect of IM3 on Time 2 max creativity	.10	.02	2.08
Effect of IM3 on Time 2 mean creativity	.09	.01	1.59
Effect of Task 2 max creativity on IM 4	.20	.04	8.84**
Effect of Time 2 mean creativity on IM 4	.21	.04	9.96**

* $p < .05$

** $p < .01$

Time 3 intrinsic motivation (IM 3) was assessed immediately before Task 2 creativity, and would be thought to have a stronger effect than IM 2. Contrary to

expectations, IM 3 did not predict Task 2 maximum creativity ($\Delta F = 2.59$), or Time 2 mean creativity ($\Delta F = 2.82$, $p<.10$). Repeating analyses without the neutral condition did not improve the relationship. Thus, hypothesis 1 was only partially supported.

Hypothesis 2

Hypothesis 2 stated that self-determination (SD) will have a positive, linear main effect on IM. To test this hypothesis, IM was regressed on SD within each time period (e.g., the effect of SD 1 on IM 1), and between time periods (e.g., the effect of SD 1 on IM 2). The effect of SD on IM was examined between time periods as well as within to support causal linkages between the two constructs. The effect of IM on SD between time periods was also examined In all cases, IM was predicted by SD as hypothesized (see Table 8).

Hypothesis 3

Hypothesis 3 stated that self-determination (SD) will moderate the effect of PC on IM such that PC will have an effect on IM only when SD is high. Low PC will always have a negative effect on IM, but high PC will have a positive effect on IM only when SD is high, otherwise increases in PC will have no effect on IM (see Figure 1). A test of moderation was performed according to the technique specified by Baron and Kenny (1986).

Table 8

The Effect of Self-Determination on Intrinsic Motivation

	β	ΔR^2	ΔF
The effect of SD 1 on IM 1	.38	.14	44.96**
The effect of SD 2 on IM 2	.47	.21	68.71**
The effect of SD 3 on IM 3	.54	.29	104.78**
The effect of SD 4 on IM 4	.41	.17	46.22**
The effect of SD 1 on IM 2	.34	.11	29.76**
The effect of IM 1 on SD 2	.31	.08	19.54**
The effect of SD 2 on IM 3	.47	.22	71.27**
The effect of IM 2 on SD 3	.45	.18	50.17**
The effect of SD 3 on IM 4	.33	.11	28.45**
The effect of IM 3 on SD 4	.51	.24	69.36**

** $p < .01$

In the first step of the analysis, the dependent variable (IM) was regressed on the moderator (SD). In the second step, the independent variable (PC) was added, and in the third step the interaction between the independent variable and the moderator (SD x PC) was added. Examining moderation within each time period (e.g., moderation of perceived competence at Time 1 (SD 1) on the effect of PC 1 on IM 1), and between time periods (e.g., moderation of SD 1 on the effect of PC 1 on IM 2) controlling for sex, age, and creativity skill revealed non-significant moderation within Time 3 ($p < .1$), and

significant moderation within Time 4, between Time 2 and 3, and between Time 3 and 4 (see Table 9 through Table 15 and Figure 8 through Figure 11).

Table 9

Test of Moderation of Time 1 Perceived Competence (PC 1) on the Relationship between Time 1 Self-Determination (SD 1) and Time 1 Intrinsic Motivation (IM 1)

	B	R^2	ΔR^2	ΔF
Step 1		.18		16.83**
Sex	0.05			
Age	-0.03			
Creativity skill	0.44**			
Step 2		.20	.02	5.35*
PC 1	0.17*			
Step 3		.33	.12	40.82*
PC 1	0.10			
SD 1	0.37**			
Step 4		.33	.00	0.12
PC 1 x SD 1	0.19			

* $p < .05$

** $p < .01$

Table 10

Test of Moderation of Time 2 Perceived Competence (PC 2) on the Relationship between Time 2 Self-Determination (SD 2) and Time 2 Intrinsic Motivation (IM 2)

	β	R^2	ΔR^2	ΔF
Step 1		.08		6.42**
Sex	0.03			
Age	-0.01			
Creativity skill	0.29**			
Step 2		.28	.20	63.27**
PC 2	0.48**			
Step 3		.45	.17	69.62**
PC 2	0.43**			
SD 2	0.42**			
Step 4		.46	.01	3.04
PC 2 x SD 2	0.59			

** $p < .01$

Table 11

Test of Moderation of Time 3 Perceived Competence (PC 3) on the Relationship between Time 3 Self-Determination (SD 3) and Time 3 Intrinsic Motivation (IM 3)

	β	R^2	ΔR^2	ΔF
Step 1		.08		6.67**
Sex	0.10			
Age	-0.03			
Creativity skill	0.30**			
Step 2		.30	.22	68.82**
PC 3	0.49**			
Step 3		.51	.21	93.83**
PC 3	0.38**			
SD 3	0.47**			
Step 4		.52	.02	7.44**
PC 3 x SD 3	0.81**			

** $p < .01$

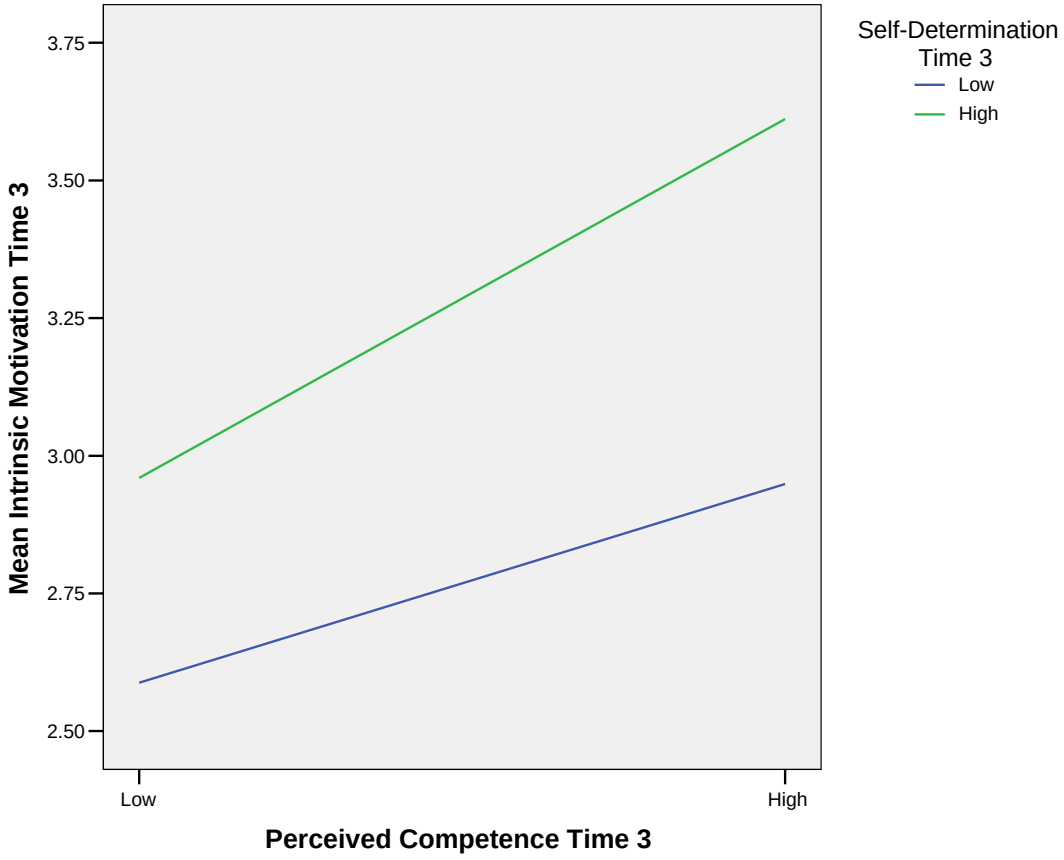

Figure 8. Effect of Time 3 Perceived Competence and Self-Determination on Time 3 Intrinsic Motivation.

Table 12

Test of Moderation of Time 4 Perceived Competence (PC 4) on the Relationship between Time 4 Self-Determination (SD 4) and Time 4 Intrinsic Motivation (IM 4)

	β	R^2	ΔR^2	ΔF
Step 1		.05		3.56*
Sex	0.08			
Age	-0.12			
Creativity skill	0.19**			
Step 2		.31	.26	83.73**
PC 4	0.53**			
Step 3		.46	.15	62.04**
SD 4	0.51**			
PC 4	0.39**			
Step 4		.47	.01	4.46*
PC 4 x SD 4	0.72*			

* $p < .05$

** $p < .01$

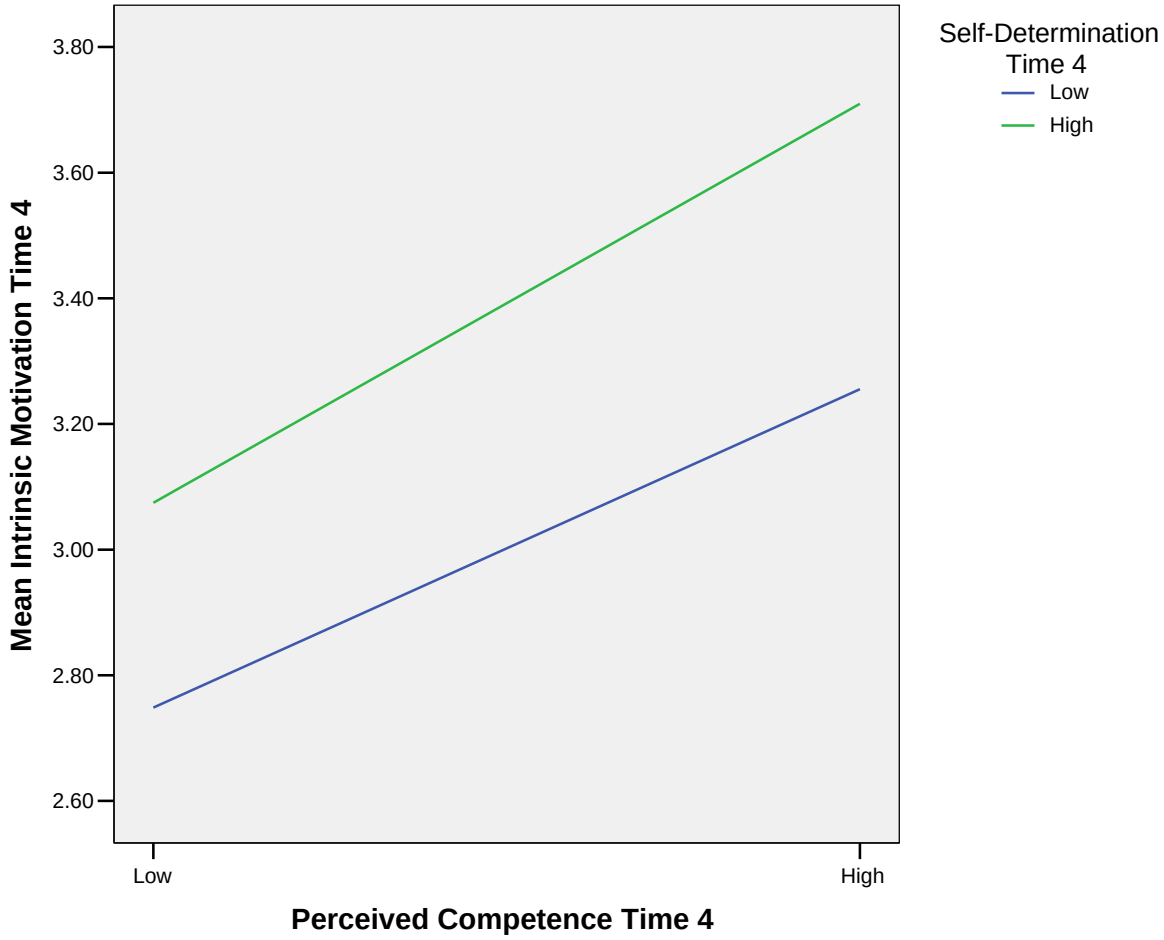

Figure 9. Effect of Time 4 Perceived Competence and Self-Determination on Time 4 Intrinsic Motivation.

Table 13

Test of Moderation of Time 1 Perceived Competence (PC 1) on the Relationship between Time 1 Self-Determination (SD 1) and Time 2 Intrinsic Motivation (IM 2)

	B	R^2	ΔR^2	ΔF
Step 1		.08		6.42**
Sex	0.03			
Age	-0.01			
Creativity skill	0.29**			
Step 2		.08	.00	0.07
PC 1	-0.02			
Step 3		.19	.11	28.86**
PC 1	-0.09			
SD 1	0.34**			
Step 4		.19	.00	0.54
PC 1 x SD 1	-0.43			

** $p < .01$

Table 14

Test of Moderation of Time 2 Perceived Competence (PC 2) on the Relationship between Time 2 Self-Determination (SD 2) and Time 3 Intrinsic Motivation (IM 3)

	β	R^2	ΔR^2	ΔF
Step 1		.08		6.67**
Sex	0.10			
Age	-0.03			
Creativity skill	0.30**			
Step 2		.18	.10	27.29**
PC 2	0.34**			
Step 3		.37	.19	67.69**
PC 2	0.28**			
SD 2	0.44**			
Step 4		.41	.04	13.09**
PC 2 x SD 2	1.28**			

* $p < .05$

** $p < .01$

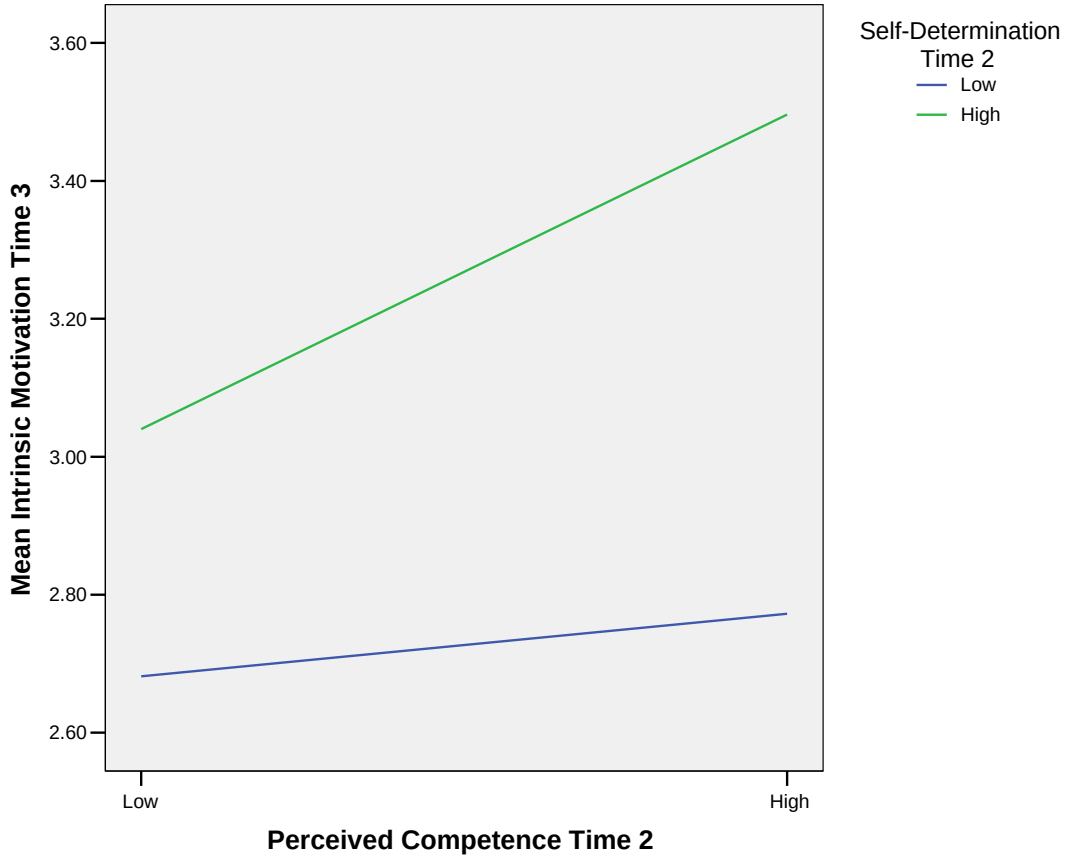

Figure 10. Interaction of Time 2 Perceived Competence and Self-Determination on Time 3 Intrinsic Motivation.

Table 15

Test of Moderation of Time 3 Perceived Competence (PC 3) on the Relationship between Time 3 Self-Determination (SD 3) and Time 4 Intrinsic Motivation (IM 4)

	β	R^2	ΔR^2	ΔF
Step 1		.05		3.56*
Sex	0.08			
Age	-0.12			
Creativity skill	0.19**			
Step 2		.10	.05	13.39**
PC 3	0.24**			
Step 3		.18	.08	22.48**
PC 3	0.18**			
SD 3	0.30*			
Step 4		.24	.06	16.84**.
PC 3 x SD 3	1.54**			

* $p < .05$

** $p < .01$

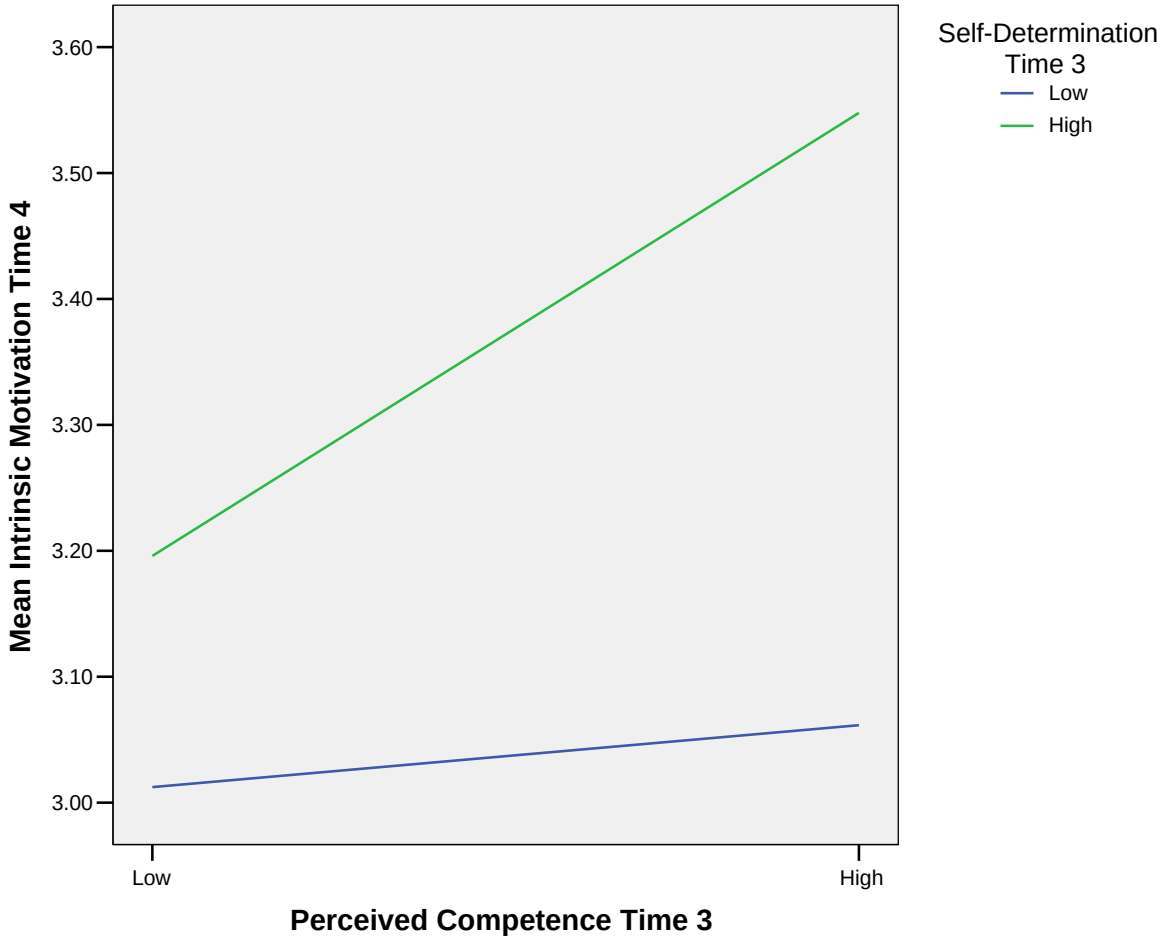

Figure 11. Interaction of Time 3 Perceived Competence and Self-Determination on Time 4 Intrinsic Motivation.

These results suggest that feedback creates the conditions necessary for moderation of SD on the effect of PC on IM, as the hypothesized effect only appeared after FB was given, not before. Hypothesis 3 suggested that any changes in PC such as the decreases shown after Task 1 should result in a moderated effect of PC on IM. This was not the case, and thus Hypothesis 4 was not supported. Feedback from the task (which occurs

after performing Task 1, but before rating IM 2) is initiated within the person, and seems to have a different effect than externally presented feedback on intrinsic motivation. The degree of self-determination present before external feedback determines whether this external feedback is perceived as controlling or autonomous. Participants who have low self-determination before external feedback tend to perceive feedback as controlling and thus increases in perceived competence do not result in increases in intrinsic motivation. Moderation was stronger between time periods, indicating that the interaction between self-determination and perceived competence predicts later changes in intrinsic motivation. It is likely that after intrinsic motivation changes, it influences later changes in self-determination and/or perceived competence in a feedback loop. Supporting this effect, IM 1 predicted Time 2 SD x PC ($\beta = 0.31$, $\Delta R^2 = .08$, $\Delta F = 20.45$), IM 2 predicted Time 3 SD x PC ($\beta = 0.50$, $\Delta R^2 = .23$, $\Delta F = 69.67$), and IM 3 predicted Time 4 SD x PC ($\beta = 0.51$, $\Delta R^2 = .24$, $\Delta F = 74.64$).

Hypothesis 4

Hypothesis 4 stated that feedback style will have a main effect on SD. Feedback presented in an autonomous style was hypothesized to increase SD, while feedback presented in a controlled style would decrease SD. Due to the interaction of problem difficulty and feedback, a 3 (Feedback Style) fixed effect x 2 (Task Difficulty) random effect ANCOVA was performed to test the effect of feedback style on SD 3. Because SD 3 was measured after feedback, the effect of SD 2 was controlled to assess the effect of the change due to feedback on IM. Both feedback style ($F(2, 3) = 257.44$, $p < .01$), and difficulty ($F(1, 10) = 28.82$, $p < .01$) had a main effect on SD 3, supporting

hypothesis 4. The interaction was not significant. Without including difficulty, feedback style did not have a main effect on SD 3 (F(2,229) = 1.94).

Hypothesis 5

Hypothesis 5 stated that SD will mediate the effect of feedback style on IM. A mediation analysis was performed according to the method specified by James and Brett (1984). Because Time 3 data was measured immediately following feedback, IM 3 was first regressed on SD 3, then SD 3 was regressed on feedback style, and finally IM 3 was regressed on feedback style and SD 3. SD 3 predicted IM 3 ($\beta = .34$, $R^2 = .12$, $F(1, 230) = 30.56$, $p < .01$), but feedback style did not predict IM 3 ($R^2 = .01$, $\Delta F(1, 230) = 1.49$). Feedback style was also not significant in the final step and there was little change in the effect of SD 3 on IM 3 ($\beta = .34$, $R^2 = .12$, $F(2, 229) = 15.22$, $p < .01$). Hypothesis 5 was not supported.

Hypothesis 6

Hypothesis 6 stated that feedback sign will have a main effect on PC. Positive feedback was expected to increase PC, whereas negative feedback would decrease PC as compared to no feedback sign. ANCOVA was performed on feedback sign, controlling for the effect of PC 2. Feedback sign was shown to have a main effect on PC 3 ($F(2, 233) = 31.94$, $p<.05$), supporting hypothesis 6.

When analyses were repeated with a 3 (Feedback Sign) x 2 (Task Difficulty) ANCOVA, feedback sign was shown to have a non-significant effect on PC ($F(2, 2) = 7.91$), while feedback sign and task difficulty had a significant interaction ($F(2, 226) = 4.26$, $p<.05$). A graph of the interaction (see Figure 12) showed that positive feedback

increased perceived competence only when the task was perceived as difficult. Means and standard deviations of PC for each feedback group are presented in Table 16 and Figure 13.

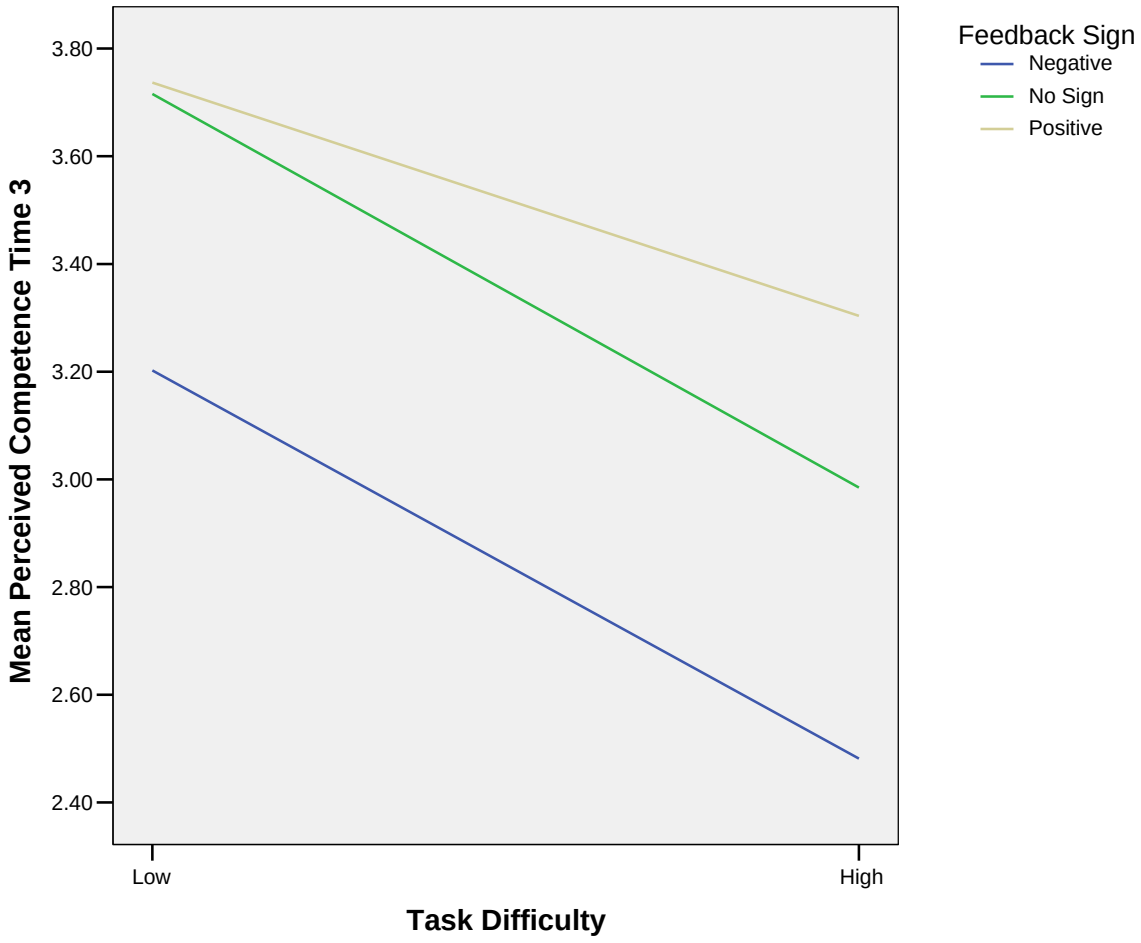

Figure 12. Interaction of Time 2 Feedback Sign and Task Difficulty.

Table 16

Means and Standard Deviation of Perceived Competence for Feedback Groups

Feedback Sign	*N*	PC 1	PC 2	PC 3	PC 4
Positive	77	3.69 (.46)	3.11 (.76)**	3.51 (.69)**	3.49 (.80)
Pos/Autonomous	25	3.74 (.45)	3.09 (.66)**	3.51 (.60)**	3.29 (.82)
Pos/No Style	26	3.62 (.45)	3.10 (.81)**	3.49 (.77)**	3.58 (.69)
Controlling	26	3.71 (.49)	3.14 (.83)**	3.55 (.72)*	3.58 (.87)
No Feedback Sign	78	3.72 (.50)	3.13 (.75)**	3.30 (.71)**	3.32 (.74)
Autonomous	27	3.75 (.36)	3.11 (.69)**	3.44 (.55)**	3.61 (.62)
No Style	26	3.80 (.62)	3.18 (.77)**	3.33 (.76)	3.10 (.79)
Controlling	25	3.63 (.47)	3.09 (.83)**	3.12 (.79)	3.24 (.71)
Negative (Overall)	78	3.70 (.46)	3.11 (.71)**	2.87 (.76)**	3.24 (.67)**
Autonomous	26	3.54 (.50)	3.00 (.58)**	2.72 (.73)**	3.24 (.78)**
No Style	25	3.89 (.38)	3.37 (.51)**	3.13 (.65)**	3.23 (.51)
Controlling	27	3.67 (.43)	2.99 (.91)**	2.77 (.83)*	3.27 (.71)
Overall	233	3.71 (.47)	3.12 (.74)**	3.23 (.77)*	3.35 (.74)**

Note: Standard deviations in parentheses.

* Significant difference with previous time ($p < .05$)

** Significant difference with previous time ($p < .01$)

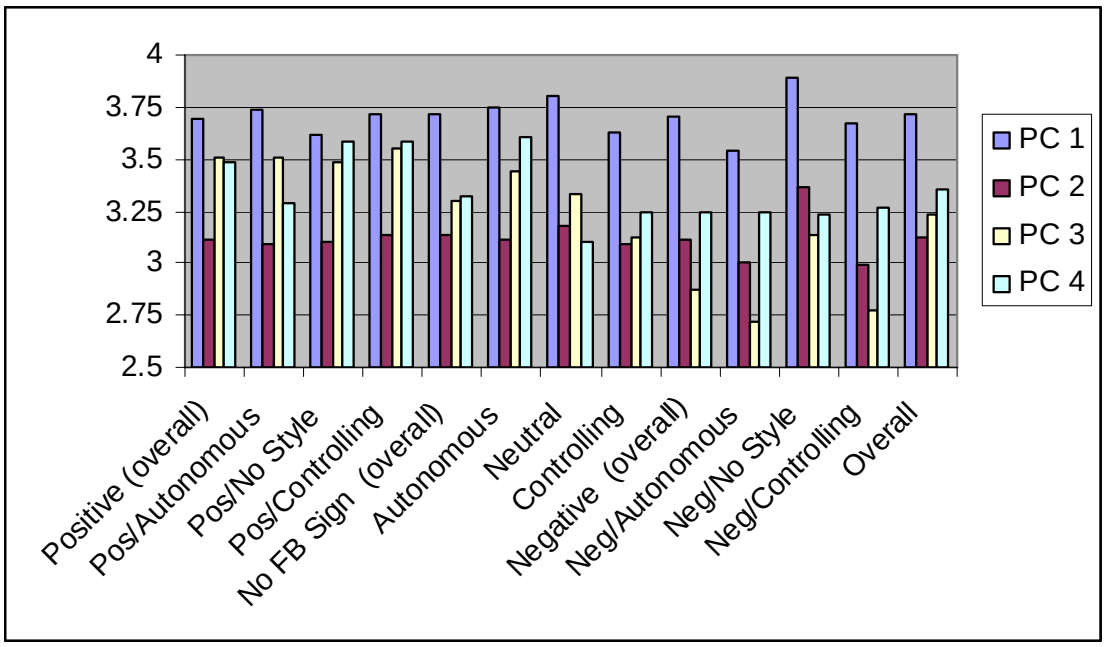

Figure 13. Means and Standard Deviation of Perceived Competence for Feedback Groups.

Hypothesis 7

Hypothesis 7 stated that perceived competence will mediate the effect of feedback sign on IM. A mediation analysis was performed according to the method specified by James and Brett (1984). IM 3 was first regressed on PC 3, then IM 3 was regressed on feedback sign, and finally IM 3 was regressed on feedback sign and PC 3. Time 3 perceived competence predicted Time 3 intrinsic motivation ($\beta = .51$, $R^2 = .26$, $\Delta F(1, 231) = 79.84$, $p < .01$). Feedback sign predicted Time 3 intrinsic motivation ($\beta = .20$, $R^2 = .04$, $\Delta F(1, 231) = 9.78$, $p < .01$). In the final step feedback sign became non-

significant ($\Delta F(1, 231) = 0.24$) leaving Time 3 perceived competence to predict intrinsic motivation ($\beta = .50$) Thus, hypothesis 7 was supported.

Hypothesis 8

Hypothesis 8 stated that IM will mediate the effect of feedback sign on creativity. A test of mediation was regressed according to the method specified by James and Brett (1984). Task 1 creativity was first regressed on IM 1. Then IM 1 was regressed on feedback sign, and finally Task 1 creativity was regressed on both IM 1 and feedback sign. Feedback sign was found to have a main effect on IM 3 ($\beta = .20$, $\Delta R^2 = .04$, $\Delta F(1, 231) = 9.77$, $p < .01$). IM 3 does not predict Task 2 creativity and feedback sign has a non-significant effect on Task 2 mean creativity ($\beta = -.11$, $\Delta R^2 = .01$, $\Delta F(1, 231) = 3.84$, $p < .10$). Interestingly however, when feedback sign and IM 3 are both added to the regression equation, feedback sign ($\beta = -.14$) and IM 3 ($\beta = .13$) predict Task 2 creativity ($\Delta R^2 = .02$, $\Delta F(1, 227) = 3.84$, $p < .05$). Feedback sign may influence creativity directly and through IM 3.

Exploratory analyses were conducted on within-subjects factors of SD, PC, and IM and between-subjects factors of task difficulty, feedback sign, and feedback style across all four time periods. Between subjects, the main effect of feedback style on PC was confirmed ($F(2, 215) = 5.76$, $p < .01$), while the interaction between difficulty and SD was not ($F(2, 215) = 0.09$).

Within subjects, PC, SD, and IM decreased significantly between Time 1 and Time 2, and increased significantly relative to previous times. Problem difficulty influenced changes in PC 2 relative to PC 1 ($F(1, 215) = 77.58$, $p < .01$), PC 3 relative to

previous times ($F(1, 215) = 5.02$, $p < .05$), IM 2 relative to IM 1 ($F(1, 215) = 22.53$, $p < .01$), and IM 3 relative to previous times ($F(1, 215) = 4.74$, $p < .05$). Feedback sign interacted with time to cause a change in between IM 3 and previous times ($F(2, 215) = 11.87$, $p < .01$). Time and feedback style had a non-significant interaction on the difference between SD 3 and previous times ($F(2, 215) = 2.63$, $p < .10$). Feedback sign and feedback style interacted with the time period to cause a change in PC 4 compared to previous times ($F(2, 215) = 4.38$, $p < .01$), and IM 4 compared to previous times ($F(4, 215) = 2.38$, $p < .05$). Feedback sign, feedback style, and task difficulty interacted with time, resulting in a difference between IM 4 and previous times ($F(4, 215) = 2.67$, $p < .05$).

As expected, SD and IM decrease along with PC after Time 1 due to feedback from the creative task. Performance feedback presented after Time 2 increases the three CET constructs relative to the previous assessments. The interaction between feedback sign and feedback style on both PC and IM is interesting and may be related to the interaction of feedback sign and feedback style on creativity found by Zhou (1998).

CHAPTER IV

DISCUSSION AND CONCLUSIONS

This study attempted to replicate the effect of feedback sign and feedback style on creativity shown by Zhou (1998). The study also extended previous research by examining changes in motivational antecedents to creativity and intrinsic motivation over time.

The effect of feedback on creativity

There are indications that both feedback style and feedback sign have main effects on creativity, but the effects demonstrated by Zhou (1998) were not replicated. Contrary to predictions, the controlling style seemed to increase rather than decrease creativity, while autonomous feedback seemed to have no effect (see Table 4). Effects were only clear after controlling for the perceived difficulty of the first creative task. It is likely that the manipulations were too complex, that the information given regarding the universality (or limitedness) of creativity could be interpreted in both a controlling or autonomous manner. Zhou's (1998) study used an inbox task with many creative problems. Difficulty probably varied across the inbox tasks, which would explain why clear effects were demonstrated.

Analyses revealed main effects of feedback style on Time 1 maximum creativity (before feedback was given), and feedback sign on Time 1 mean creativity. There is no clear explanation for these effects, but it is likely due to random chance.

The effect of self-determination on intrinsic motivation

Self-determination predicted intrinsic motivation in all cases, strongly supporting the link between these two variables. In all but one case, the effect of self-determination on intrinsic motivation between time periods was larger than the effect of intrinsic motivation on self-determination, indicating a causal relationship between self-determination and intrinsic motivation, and a possible feedback loop in which intrinsic motivation influences future self-determination. The only exception was the effect of Time 3 intrinsic motivation on Time 4 self-determination which demonstrated an effect size of more than double the effect of Time 3 self-determination on Time 4 intrinsic motivation. In contrast to this, the effect of intrinsic motivation on perceived competence was of similar though lesser magnitude across all time periods. This indicates that the large effect of Time 3 intrinsic motivation on self-determination was due to the interaction of time period and self-determination rather than a main effect of time period that would affect the relationship between intrinsic motivation and self-determination as well as the relationship between perceived competence and intrinsic motivation. Intrinsic motivation also increased across all conditions after the final creativity task, which may have affected the relationship between Time 3 self-determination and Time 4 intrinsic motivation, but if that was the case, it should have affected the relationship between Time 3 perceived competence and Time 4 intrinsic motivation in a similar manner. The effect of Time 3 self-determination on Time 3 intrinsic motivation was also higher than any other condition.

It is possible that there is a unique relationship between self-determination and intrinsic motivation, in which the two constructs influence each other in a feedback loop, and that effect is stronger than a similar effect between intrinsic motivation and perceived competence. Perceived competence may be a more socially constructed construct than self-determination. People seek feedback to verify their perceptions of competence, and although self-determination can be influenced by feedback, that feedback is likely seen as controlling, and not originating from within the person. This proposition is supported by the effect of SD, PC, and IM in the neutral condition. Between Time 1 and Time 4, perceived competence decreased with a 95% confidence interval (0.37, 1.03), while self-determination remained the same with a 95% confidence interval (-0.17, 0.50). As a function of both perceived competence and self-determination, intrinsic motivation also decreased with a 95% confidence interval (0.25, 0.80). Lack of feedback decreases perceived competence, indicating that people require feedback to maintain perceptions of competence, while the internal sense of self-determination remains stable.

It is certainly reasonable to conclude that the relationship between self-determination and intrinsic motivation is different than the relationship between perceived competence and intrinsic motivation. Feedback was shown to change the relationship between self-determination, perceived competence, and intrinsic motivation. In pre-feedback conditions, both self-determination and perceived competence have main effects on intrinsic motivation, but after feedback, self-determination was shown to moderate the effect of perceived competence on intrinsic motivation within and between

time periods. The effect was stronger between time period than within, supporting the causal model of self-determination and perceived competence on intrinsic motivation. To clarify, self-determination and perceived competence have main effects on intrinsic motivation. When an event such as feedback affects perceived competence, the level of self-determination before feedback determines the effect of perceived competence on intrinsic motivation.

Results showed that both perceived competence and self-determination had main effects on intrinsic motivation. Furthermore, self-determination and perceived competence had an interactive effect on intrinsic motivation in all cases where intrinsic motivation was measured after the presentation of feedback. When measured between time periods, adding self-determination to a regression equation predicting intrinsic motivation from perceived competence resulted in a decreased effect of perceived competence. When measured within time periods, there was little to no change in the effect of perceived competence on intrinsic motivation. This indicates that between time periods, the effect of perceived competence on intrinsic motivation depends on self-determination, but this is not the case within time periods. Exploratory analyses conducted to support hypothesis 5 indicated that there was an overall negative effect of the first creative task on the perceived competence and intrinsic motivation of participants. The strongest interactions were due to the effect of Time 3 self-determination and perceived competence on Time 4 intrinsic motivation ($\Delta R^2 = .06$), followed by the interaction of Time 2 self-determination and perceived competence on Time 3 intrinsic motivation ($\Delta R^2 = .04$). It is interesting that the effect after Task 2

creativity would be larger than the effect after feedback. The level of difficulty was shown to interact with feedback when determining changes in creativity and intrinsic motivation.

Feedback and self-determination

As expected, perceived competence mediated the effect of feedback sign on intrinsic motivation, but the effect of feedback style on self-determination was unclear. Examination of the effect of feedback style on self-determination showed an effect when the task difficulty was included as a random factor. While this effect was not hypothesized and may be unique to this study, it does provide some support to the hypothesis proposing a relationship between feedback style and self-determination. Results indicate that task difficulty influences changes in perceived competence, intrinsic motivation, and interacts with feedback sign to influence maximum and mean creativity and interacts with feedback style to determine maximum creativity. It is clear, however, that the feedback style manipulations did not have the intended effect on participant perceptions and creative performance. Future studies should examine these effects in a situation where both feedback style and feedback sign have clear effects on creative performance.

The effect of intrinsic motivation on creativity

Pre-feedback intrinsic motivation predicted creativity according to expectations, but the post-feedback (Time 3) intrinsic motivation, did not predict Task 2 creativity. Additionally, Task 2 creativity predicted Time 4 intrinsic motivation. Feedback was shown to affect creativity directly, and feedback was shown to affect intrinsic motivation

through perceived competence. If the lack of effect between manipulated intrinsic motivation and creativity is a correct retention of the null hypothesis rather than Type II error, it has significant implications for the creativity literature. Intrinsic motivation is often not measured directly in creativity studies (e.g., Shalley, 1995; Zhou, 1998), probably because early studies (e.g., Amabile, 1979) have demonstrated that manipulations which affect creativity also affect intrinsic motivation. Intrinsic motivation has rarely been assessed in a repeated measures design, instead intrinsic motivation is usually measured after the completion of the experiment. The results of the current paper suggest that feedback affects creativity and intrinsic motivation separately, and would explain why intrinsic motivation has not been shown to mediate the effect of experimental manipulations on creativity. The question remains, however, why and how do manipulations affect both intrinsic motivation and creativity? The operationalization of intrinsic motivation, intrinsic interest, is not necessarily the same as intrinsic motivation. It is possible that the latent variable of intrinsic motivation affects both intrinsic interest and creativity. Future studies should investigate the relationship of intrinsic motivation and creativity using structural equation modeling to test this relationship.

Implications for cognitive evaluation theory

Cognitive evaluation theory proposes that feedback (style) has informational, controlling, and amotivational components. The current study intended to manipulate the controlling component, viewing it as a continuous dimension with autonomy-supporting feedback on one end, and autonomy-controlling feedback on the other end.

The feedback presented was confounded by what might be viewed as an amotivational component to feedback. Participants in the controlling condition were told that "Creativity is limited to a gifted few," while participants in the autonomous condition were told that "Creativity is a trait common to all people." Although the interaction between amotivating feedback and controlling feedback cannot be determined, it appears that high controlling feedback may interact with amotivating feedback and task difficulty, in a way such that high controlling and amotivating feedback presented in a task that has a low difficulty will be construed as autonomous feedback. According to Deci & Ryan (1985) no studies have attempted to manipulate amotivation directly.

Self-determination appears to be closely linked to intrinsic msotivation. Between and within time periods, changes in one construct predicted changes in the other. Perceived competence had no effect on intrinsic motivation under the baseline conditions when the effect of self-determination is controlled (see Table 9 and 13). Perceived competence only demonstrates an effect on intrinsic motivation when it changes significantly.

The role of self-determination and perceived competence in determining intrinsic motivation seems to be more complex than proposed by Deci and Ryan (1985). According to cognitive evaluation theory, perceived competence will only affect intrinsic motivation within the context of self-determination such that in conditions of low self-determination, perceived competence will have no effect. The current study suggests that in situations where self-determination, intrinsic motivation, and perceived competence are relatively stable, self-determination does not affect the relationship

between perceived competence and intrinsic motivation. After task 2, the perceived competence of participants decreased, but self-determination did not, and the two constructs did not have an interactive effect on intrinsic motivation. Self-determination seems to only interact with perceived competence when some aspect of the environment causes a perception of lowered self-determination.

Limitations and future research directions

The current study used undergraduate students enrolled in introductory psychology classes as participants. While this does limit the external validity of the findings, and future research should attempt to replicate the experiment in a work setting, the sample is relevant to applied psychologists. As the baby boom generation approaches retirement, their children will become a significant part of the work force. Zhou (1998) used undergraduate business students, and this study attempted to replicate some of her results with a broader sample of undergraduate majors.

It is possible that the believability of the feedback manipulation was low. At least one participant doubted the accuracy of the feedback, writing a message to the experimenter demonstrating disbelief in the feedback deception. It is possible that more participants were able to see through the feedback deception, limiting the effectiveness of the feedback. Future studies should manipulate feedback in a more believable manner, possibly by revealing actual judges, or by handing participants a copy of their task solutions with feedback handwritten on the sheet.

The current study has significantly contributed to both the creativity and cognitive evaluation theory literature, but was limited by an imprecise operationalization

of feedback style. Future studies should examine the three feedback style variables (i.e., informational, controlling, and amotivating) more closely to ascertain the specific main effects and interactions with feedback sign and task difficulty.

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APPENDIX A

Creative Tasks

Task A

You might not know it, but some of our group members have joined the intramural softball league. Up to now it has been great for the group. We have been developing better friendships with each other and our more members attend our weekly meetings than ever before. Anyway, I guess the softball league has become very competitive because, many of the members who are on different teams are still being competitive during our fundraising campaigns. Sometimes they don't talk to each other (when they are supposed to be working together), and are sometimes rude to each other. I think that it is actually hurting our charity work. Can you think of a creative way to turn this softball thing around to be a positive thing instead of a negative?

Task B

We are moving into our campaign to raise money for the Multiple Sclerosis Association. I'd like your input on the best way to motivate people to raise more money. I thought of setting up a contest among our members with a trip to Hawaii for the person who raises the most money in the next six-month period. I thought that this prize would be good enough to motivate our members. Do you have any other creative suggestions?

APPENDIX B

Length was measured with a 4 points scale (1=1 to 2 words, 2=3 to 4 words, 3=more than 4 words, but not more than a sentence, 4 = more than one sentence). Grammar was measured with a 3 point scale (1 = does not resemble a sentence, 2 = resembles a sentence but has minor grammatical problems, 3 = complete grammatical sentence). Spelling was measured with a 4 point scale (1 = more than two spelling errors, 2 = two spelling errors, 3 = one spelling error, 4 = no spelling errors). Clarity was measured using a 4 point scale (1= very unclear, 2 = unclear, 3 = somewhat unclear, 4 = clear). Detail was measured with a 4 point scale (1 = short answer, no detail, 2 = some detail, 3 = a lot of detail, 4 = an unusual amount of detail). Effort was measured with a 4 point scale (1 = no effort, 2 = some effort, 3 = acceptable effort, 3 = good effort).

Length
0 – cannot assess
1 – does not resemble a sentence (no subject/verb)
2 – resembles a sentence, but has some minor grammatical problems
3 – complete, grammatical sentence

Spelling
0 – cannot assess
1 - More than two spelling errors
2 – Two spelling errors
3 – One spelling error
4 – No spelling errors

Clarity
0 – cannot assess
1 - totally unclear - you cant understand what the person is trying to say
2 – very unclear – some thought required to understand how the solution relates to the problem
3 – somewhat unclear - you know what they are trying to say, but it could be stated more clearly
4 – clear - shows how it answers the problem posed

Amount of detail
0 – cannot assess
1 – short answer, no detail
2 – some detail
3 – a lot of detail
4 – an unusual amount of detail

Effort
0 – cannot assess
1 – No effort was put into this answer
2 – Some effort was used, but not much
3 – The effort level seems acceptable, but does not distinguish the participant
4 – The effort level is very good, this participant went above what you would expect

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