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Process Performance Feedback and Quality Goal Setting as Sources of Process Restrictiveness and Behavior Guidance in Electronic Brainstorming*

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〈Content〉

Ⅰ. Introduction

The more business intensifies, the more creative innovation is demanded to attain sustainable competitive advantages against others (Joo et al., 2014; Jung et al., 2013; Kim et al., 2016). The problem-solving approach, which refers to a mental process of producing feasible quality ideas, is most closely linked to creative innovation (Jung, 2012, 2015). Accordingly, many techniques, such as Face-to-Face Brainstorming (F-to-F), Nominal Group Technique (NGT), and Electronic Brainstorming (EBS), have been created to help bring about the stream of divergent thinking, a key to novel and creative solutions. Among these three methods mentioned above, the overall benefit of EBS as an another option to F-to-F and NGT has long been disputed because documentation so far indicates that the performance of EBS is not sufficient enough when compared to that of NGT (which is just paper-and-pencil-based) (see table 1 from Pinsonneault et al., 1999).

It is assumed that the possibilities and potentials of the integral features of EBS (e.g., parallel input submission, group memory, and

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anonymity) may have been offset by the persisting process losses, such as attenuation blocking, cognitive inertia, social or cognitive loafing (see Pinsonneault, et al., 1999 for more details). Pinsonneault et al. (1999) assert that "avoiding or eliminating the process losses that undermine creativity may be more effective in enhancing group productivity than reinforcing the process gains" (p. 378).

Given the proneness of performance neutralization in EBS interaction, which performance levels in the direction of the average performers, this singularity happens due to the conjoined effect of various factors. First, random group composition, which controls any potential limitations to internal validity, has been placed to set up experimental groups. Statistically, this practice includes lower performers and higher performers evenly in each group. Second, each individual's performance is not rewarded or punished based on their performance behaviors because of anonymity. This makes each individual hard to determine the rate or amount of their own performances. Third, the computer screen called the group interface, which shows all comment submissions, group members enter into "social comparison and matching" of their performances to that of others based on their own judgements. In the "social comparison and matching" process, incompetent performers are prone to begin positive social comparisons if they are with proficient performers, whereas competent performers tend to begin negative social comparisons if they are with incapable performers.

In sum, the use of the integral built-in features are intended to increase process gains in the interaction process. However, some of the features appear to cause (and even help facilitate) process losses to occur. Thus, this study focuses on "social comparison and matching" among various psycho-social process loss factors to gain an insight of why

<Table 1> Studies Comparing EBS with NGT

Study	Task	Sample N Group (Size)	Results: Productivity	Results: Satisfaction
Valacich, Dennis, Connolly (1994)	Exp. 1: Stakeholder	7 (3) P-Nominal	EBS = *P*-Nominal (3)	No Measure for Nominal
		5 (9) P-Nominal	EBS > *P*-Nominal (9)	
		5 (18) P-Nominal	EBS > *P*-Nominal (18)	
	Exp. 2: Stakeholders	6 (4) P-Nominal	EBS = *P*-Nominal (4)	EBS > P-Nominal
		6 (8) P-Nominal	EBS = *P*-Nominal (8)	
		7 (12) P-Nominal	EBS > *P*-Nominal (12)	
	Exp. 3: Tourism	5 (6) P-Nominal	EBS < *P*-Nominal (6)	EBS > P-Nominal
		5 (12) P-Nominal	EBS > *P*-Nominal (12)	
Dennis, Valacich (1993)	Tourism, Security	12 (6) P-Nominal	EBS = *P*-Nominal (6)	EBS > P-Nominal
		16 (12) P-Nominal	EBS > *P*-Nominal (12)	
Gallupe, Bastianutti, Cooper (1991)	Thumb	40 (4)	EBS = Nominal	EBS > Nominal
Gallupe, Cooper, Bastianutti (1990)	Thumb	30 (4)	EBS = Nominal	EBS > Nominal
Cooper, Gallupe, Lalonde (1990)	Tourism	30 (4)	EBS = Nominal	EBS > Nominal

individuals using EBS are not fully taking advantage of benefits of the built-in functions in the interaction process. This brings a research question that if there is a plausible way to discourage negative comparison and to encourage positive comparison at the same time in the interaction process, EBS may be more productive.

Since motivation to depress negative comparison and to foster positive comparison has been thought as the result of the interaction process (Hackman and Morris, 1975) and EBS-based groups are more task-focused, we aim to reward or punish task performance behavior by combining (1) the concept of process control, which is a broadly used operational method to detect changes in processes by analyzing past event (i.e., task behavior in this case) and by monitoring current and future performance related events, and (2) the theory of goal setting, which guides people's perceptions and directs their behavior to focus on the positive outcome. This is expected to guide performance behavior to a better direction, mitigating performance neutralization to a certain degree and, in turn, enhancing EBS productivity.

Ⅱ. Prior Studies

2.1 Performance Feedback (Jung et al. 2010 Study)

The Porter-Lawler motivation model indicates that the lack of performance related information undermines motivational linkages between effort-to-performance and performance -to-reward (Luthans, 2002). Thus, performance related information takes a critical role in controling suitable behavior by rewarding as a means of social recognition and in turn stimulating individuals to perform better. However, in the context of idea generation which reflects creativity, intrinsic over extrinsic motivation is often promoted. In addition, the prevailing conventional assumption "there is no such thing as a bad idea" has been tacitly accepted since the introduction of brainstorming. As results, anonymity for all comment submissions has been guaranteed in EBS-based idea generation, bounding the ability to monitor and control performance behavior. Furthermore, the sameness principle is used in rationing rewards after piling all comment submissions. Combined together, perceived fairness is critically weakened.

Despite previous studies' suggestion that making individual performances noticeable and evaluable encourage members to raise their productivity, no studies except Jung and colleagues' studies have considered this option to explore. Nonetheless, Jung et al. (2010) adopted the performance feedback technique within an EBS environment and reported a consistent, significant performance gain. It appears that noticeable and evaluable

performance related information influenced subjects to be competitive, inducing positive social comparison. However, the performance feedback study tested the quantity-related feedback only based on the long-standing assumption (i.e., “quantity breeds quality” (Osborn, 1957)), not including the quality-related feedback. They observed that the quantity performance feedback alone does not have enough restrictiveness to consistently monitor and control the performance behavior until the end of the idea generation session. Compared to the earlier stages where individuals were guided by the real-time visual performance feedback, which creates a competitive atmosphere, individuals figured out that performance feedback was based on the number of their comment submissions, not the amount of their efforts in the later stages. Consequently, individuals showed a proneness of self-presentation by settling on ideas of which quality was rather frivolous and even irrelevant. In sum, less restrictiveness of the new feature (i.e., quantity-related performance feedback), which did not distinguish the amount of efforts put forth to reward proper performance behaviors accordingly, induced an unintended consequence.

2.2 Process Performance Feedback (Jung 2014 Study)

The objective of brainstorming is to come up with “as many quality ideas as possible,” suggesting the importance of both quantity and quality. Austin and Bobko (1985) note that “if quality were a crucial outcome [as in brainstorming], then not including a quality measure of performance leads to criterion deficiency” (p. 291). Prior studies also suggest high correlation between quantity and quality (Jung, 2012; Pinsonneault and Heppel, 1998). Thus, both aspects (quantity and quality) of performance feedback need to be equally provided to induce proper stimulation in the interaction process.

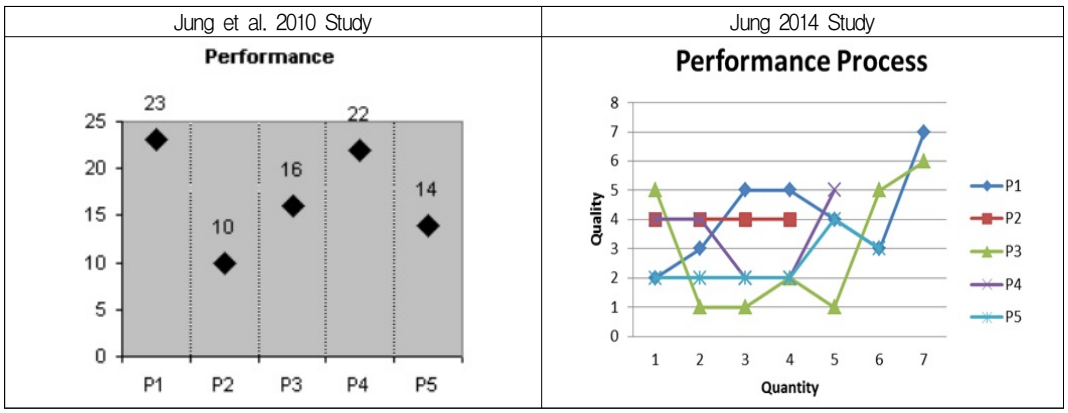
Jung (2014) designed quantity-quality performance feedback in a form of process performance feedback to display individuals’ performances two-dimensionally (quality of ideas vertically and quantity of ideas horizontally). In addition, as individuals’ comment submissions piled up, process performance feedback showed performance annals by linking the sequence of ideas in a time-series format (see figure 1). Despite a hope for better performance, an interesting finding was that although the process performance feedback had an effect, its impact on performance was insufficient when compared to that of quantity-based feedback.

Jung (2014) suggested to include the goal setting theory into the process performance feedback. Locke and Latham (2002) concluded that goals (or intentions) can promote task performance as they motivate people to put out

effort, encourage people to endure, and direct people to concentrate on the outcome. In other words, goals provide average standards for systematic self-evaluation. Whereas process performance feedback alone only establishes ambiguous and general performance targets, quality goal setting could establish specific performance targets, which help individuals to determine their performances more accurately (Jung et al., 2010). Yet, without clear feedback, goal setting is less effective, as there is no objective mechanism to guide the individuals in the progress of their attempts to reach the goal (Luthans, 2002).

Ⅲ. Theoretical Framework and Hypotheses

The reason to bring together the process performance feedback and the quality goal setting is to increase task-related productivity by designing a procedure to establish a true competitiveness by inducing sustained competitiveness and sustained peak-performance. The procedure takes place as follows: (1) the idea quality goal guides individual's performance behavior in the direction of an expectation for each and every comment submission; (2) process performance feedback visually displays individuals' performances two-dimensionally (quality for each idea vertically and quantity of ideas horizontally) and promotes two-dimensional social comparison and matching in the interaction process. In the comparison process, the self-improvement motive (the tendency to compare themselves to better performers) induces positive social comparison to match the performance of the most proficient group members for both quality and quantity of each idea. Additionally, the process feedback reveals performance annals as individuals' comment submissions accumulate and has a



<Figure 1> Quantity Performance Feedback vs. Quantity-Quality Performance Feedback

capability to pin-point junk comments (i.e., comments that are rated as infeasible). As a result, process performance feedback and goal setting combined establishes a full control of performance behavior to be task-oriented, sustaining a true competitiveness until the end of the session. Thus, the following is hypothesized:

H1: Groups in the process performance feedback / goal setting condition will perform better than groups in the process performance feedback condition.

H2: Groups in the process performance feedback / goal setting condition will perform at least the same as (or performance better than) groups in the quantity-based performance feedback.

Ⅳ. Methods and Results

Since this is a follow-up study of Jung's 2014 study, the same experimental procedure is replicated, except that the process performance feedback is modified to include goal setting.

4.1 Participants and Research Design

We compare and contrast the performance outcomes from this study and prior two studies (i.e., Jung et al., 2010 and Jung, 2014). Thus, 25 undergrad business students were invited for this study only. The subjects' average age was 22.3 years and 57 percent were male. Subjects were put to the five treatment groups randomly.

4.2 Task

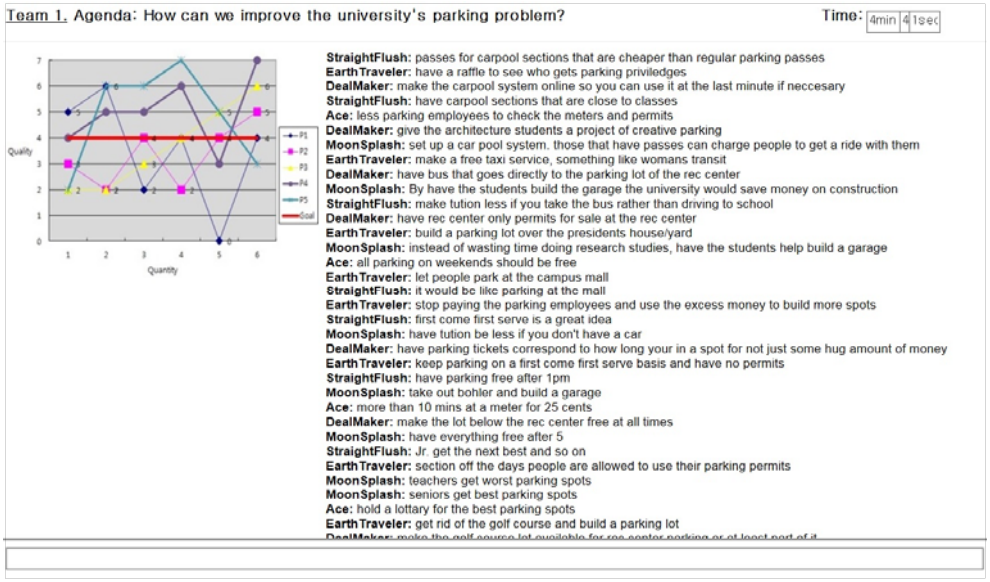
Subjects were solicited to work on ideas: "How can we improve the university's parking problem?" This question was selected because many prior studies have used (e.g., Garfield et al., 2001; Jung et al., 2010) and because it urges subjects to bring in their personal knowhow and experience.

4.3 Operationalization of Quality Rating

A digital dashboard was developed to monitor all subjects' performances. Two experts trained at least two years were guided to rate comment submissions real-time. Subjects in the feedback conditions were told that an integral built-in quality algorithm would measure their submissions based on certain rules. This further controls any potential confounding effects in the experimental setting.

4.4 Operationalization of Identifiability and Process Performance Feedback / Goal Setting

In order to come up with pseudo names for



<Figure 2> Process Performance / Goal Setting Graph

the Identifiability conditions, we gathered a pool of pseudo names. Then, fifty gender-neutral names were chosen. Regarding Process Performance Feedback / Goal Setting, we programmed a real-time electronic visual representation of individual performances. Regarding the quality goal, it was set at rate 4. Since the quality was rated between 1 (a very poor solution) and 7 (a very good solution) by domain experts, 4 represents an average quality score. The performance graph summarized cumulative comment submissions for all subjects in a group, allowing performance comparison with others and was refreshed every ten seconds.

4.5 Procedure

Subjects were told that they would produce and exchange ideas with others in the assigned group using EBS. Subjects were told that their comment submissions could be notified by the alloted pseudo names so that they could evaluate each other's performance. In addition, they were told that n integral built-in quality algorithm would rate comment submissions based on certain rules, ranging quality from 1 (lowest) to 7 (highest). In fact, the trained experts sitting in the adjacent room read and rated comment submissions real-time through the digital dashboard. Moreover, they were told that the quality score 4 represents an average quality score, and they were encouraged to generate ideas with the quality score 4 or above (as indicated by a line in the graph). After a practice task, the experimenter guided subjects to follow Osborn's (1957) brainstorming rules (i.e., "to generate as many

ideas as possible, to withhold criticism, to include wild ideas, and to build on the ideas of others"). EBS ran for 15 minutes.

4.6 Dependent Variables

Quantity and quality score of ideas were the dependent variables. The way these measures were operationalized is consistent with other prior studies (e.g., Garfield et al., 2001; Jung et al., 2010).

4.7 Results

Table 2 presents a summary of means and standard deviations for the dependent variable. An alpha level of .05 was used for statistical tests. Hypothesis 1, that groups in the process performance feedback / goal setting condition will perform better than groups in the process performance feedback condition, was supported. Independent t-tests showed increased performance of groups in the process performance feedback / goal setting condition on both quantity and quality of ideas ($p < .05$). Hypothesis 2, that Groups in the process performance feedback / goal setting condition will perform at least the same as (or performance better than) groups in the quantity-based performance feedback, was also supported. Independent t-tests showed no performance differences between the two studies (i.e., the current study vs. Jung et al. 2010 study) on both quantity and quality of ideas ($p > .05$). In addition, since Jung et al.'s (2010) study reported the results based on feasible ideas that are rated 3.0 or higher (on a 7-point scale), this study also analyzed the data based on feasible ideas and showed the same outcome patterns.

As expected, the results showed that the inclusion of goal setting into the process performance feedback solved the issue in the previous study. That was the lower than expected effect of process performance feedback on productivity when compared to that of quantity-based feedback. Studies (e.g., Jung et al., 2010, the current study) have consistently demonstrated that a goal is "what an individual is trying to accomplish" (Locke

<Table 2> Performance Comparison among Studies

	Current Study (Process Feedback / Goal Setting)	Jung 2014 (Process Feedback)	Jung et al. 2010 (Quantity-Based Feedback)
Quantity			
M	70.82	59.20	69.62
SD	12.32	9.68	19.94
Quality			
M	163.72	135.84	160.08
SD	32.14	29.24	47.95

et al. 1981, p. 126) and motivates people to put forth effort to perform better. It appears that goals deliver standards for structured self-evaluation, strengthening the linkage between effort and performance. Thus, goals seem to set up a self-fulfilling prophecy, preconditioning better performance.

Ⅴ. Discussion

The "process gains and process losses" approach (Pinsonneault et al., 1999) asserts that the productivity of group-based idea generation depends on the balance between process gains and process losses. Among the factors related to the gains and losses, prior studies (Jung et al., 2010; Pinsonneault et al., 1999) point out cognitive mental processes and motivation (both intrinsic and extrinsic) as the two major candidates that may change the balance between process gains and process losses. Given the role of cognition and positive side of social facilitation to be critical in enhancing idea generation productivity, negative side of social facilitation (i.e., downward social comparison and matching) has been viewed only a secondary element in the loss of productivity in group idea generation because the task is generally considered as being "practically effortless."

In this study, we argued that social comparison and matching leads to performance neutralization in computer-based idea generation groups. We further argued that the occurrence of social comparison and matching relates to cognitive stimulation or cognitive interference. If the former (i.e., stimulation) is greater than the latter (i.e., interference) in the interaction process, motivation toward positive comparison could be induced. Paulus and Brown (2003) suggest that although intrinsic motivation is critical in creative ideation, external factors could play a meaningful role to enhance the ideation productivity in relatively short-term settings. Since the use of brainstroming rules (Osborn, 1957) - an instruction intended to guide subjects to focus on producing feasible quality ideas – reduce process losses cannot offset the proneness to delve in negative productivity matching in the interaction process, group-related researchers have called for alternative interventions such as performance feedback (e.g., Jung et al., 2010; Jung, 2014). Luthans (2002) further delineates that "the performance feedback should be clearly delivered as an external intervention and be as positive, immediate, graphic, and specific … as possible to be effective (p. 552)." Similarly, Gray et al. (1993) point out that "to the user, the system is the interface" (p. 192) because the computer screen is the only communication channel to individuals in computer-based idea generation. Taken together, the design of the group interface could be an important determinant for

performance enhancement, but little is known about the influence of the design of the group interface on ideation performance, except Jung and colleagues' studies (Jung et al., 2010; Jung, 2014).

5.1 Implications for Research

Despite the employment of various techniques (e.g., quantity-quality-based feedback, goal setting) in an effect to mitigate performance measure deficiency, the outcome still showed that its performance magnitude is unsatisfactory because the outcome of this study turned out to be no better than the outcome of just quantity-based performance feedback in Jung et al.'s (2010) study. This could reduce the net benefits of using such a feedback system as an option to increase the productivity of computer-based idea generation. As pointed out that the design of the group interface could be an important determinant for performance enhancement, one possible explanation is that there might be a threshold in reading and interpreting the performance graph on the computer screen. The quantity-quality-based process performance feedback, which is intended to reveal performance histories by accumulating past task behavior, seems to require more cognitive effort to keep track of their own performances when compared to that of the quantity-based performance feedback, which is rather simple to follow and contrast. Given that the inclusion of the performance feedback graph in computer-based idea generation consistently leads to better performance, an in-depth examination of the level of graph readability is a research opportunity.

In other studies, Jung (2010, 2012) pointed out that the proportion of junk comments (i.e., comments that are irrelevant to task performance) built up on average 34% (SD 13%) and the ratio of lower quality ideas to higher quality ideas was about three to two. In such an environment, junk comments could interfere or distract individuals' ideation processes. Therefore, stimulation for cognitive mental processes is less likely to occur. The theory of "negative-positive asymmetry," which refers to "events that are negatively valenced [(i.e., events that induce process losses)] … will have a greater [and longer lasting] impact on the individual than positively valenced events [(i.e., events that induce process gains)]" (Baumeister et al., 2001, p. 323), supports that the proneness toward "negative-positive asymmetry" will appear stronger in computer-based ideation groups because junk comments are repeatedly displayed on the computer screen called group interface. Jung (2012) consistently suggests that one way to alleviate the contagious effect of junk comments is to pro-actively filter junk comments whenever occur. However, the (quantity-quality-based) process performance

feedback and goal setting could be an another option to control junk comments because the quantity-quality-based performance annal provided has a capability to pin-point junk comments when the quality scores are rated lower. In this way, if an individual generates junk comments, that individual can be notified and sanctioned accordingly. When people are faced with sanctions in the form of quality performance feedback, they are likely to take steps to assure a positive outcome of the evaluation, or at the very least attempt to forestall frivolous comments. This increases social pressure to accomplish the task and accountability. Under such condition, human cooperation will be the greatest because a strong performance norm toward higher quality ideas would emerge, leading individuals to control their efforts to meet or exceed appropriate public behavioral standards (Carver, 2004). Thus, comparing the ratio of junk comments of three studies in table 2 could be another avenue of research opportunity.

5.2 Limitations

Like other experimental studies, this study shows some limitations in certain aspects. We used a laboratory experiment with student subjects. Although the setting was not natural, such artificiality was a necessary and sufficient condition to test the hypotheses with precision. Another limitation is related to the unbalanced gender distribution of subjects. We, however, ran various statistical tests and consistently found no evidence to support a gender effect. This finding confirms with prior studies (Garfield et al., 2001; Jung et al., 2010) that have investigated the influence of varying gender compositions, finding no gender effect in idea generation tasks.

Ⅵ. Conclusion

Prior studies evidence and demonstrate a significant performance gain by the provision of real-time performance information about who is putting effort and who is not. However, it has been observed that the quantity performance feedback alone does not have enough restrictiveness to consistently control and regulate the performance behavior throughout the idea generation session. We modified the process performance feedback mechanism to include goal setting to regulate performance behavior by strengthening the linkage between effort and performance. The result suggests that the combination of process performance feedback and goal setting can influence task performance. However, the treatment's effect shows less than expected performance magnitude, which needs further examination in the future.

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<Abstract>

Process Performance Feedback and Quality Goal Setting as Sources of Process Restrictiveness and Behavior Guidance in Electronic Brainstorming

Jung, Joung-Ho

Purpose

Through the provision of real time performance information about who is contributing and who is not in Electronic Brainstorming, prior studies evidenced a significant performance gain. However, it has been observed that the quantity-based performance feedback alone does not have enough restrictiveness to guide the performance behavior throughout the idea generation session. We included the notion of goal setting into the process performance feedback mechanism in an effort to regulate performance behavior and to better understand why individuals in Electronic Brainstorming are not obtaining enough stimulation benefits in the group interaction process.

Design/methodology/approach

We had developed real-time visual process performance feedback and modified to include goal setting. This mechanism visually displays individuals' performances two-dimensionally (quality for each idea vertically and quantity of ideas horizontally along with their goals). As individuals' contributions accumulate, the mechanism reveals performance histories by connecting the sequence of ideas in a time-series format, telling stories of individuals' performances. Then, we compared the performance outcome from this study with the outcomes from two prior studies (i.e., Jung et al., 2010 and Jung, 2014).

Findings

The results showed that the inclusion of goal setting into the process performance feedback solved the issue in the previous study. That was the lower than expected magnitude of performance enhancement of process performance feedback when compared to that of quantity-based feedback. It appears that goals as a motivational technique provide standards for systematic self-evaluation,

serving as a cue to regulate performance behavior by strengthening the linkage between effort and performance. Thus, goals seem to set up a self-fulfilling prophecy, preconditioning better performance. However, the outcome still showed that its performance magnitude is unsatisfactory because the outcome of this study turned out to be close to the outcome of just quantity-based performance feedback in Jung et al.'s (2010) study.

Keyword: Idea Generation, Process Performance Feedback, Goal Setting

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