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MARK FICHTEL

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WHERE WAS I?

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BY THE COMMITTEE CONSISTING OF

Dr. Michael Mumford, Chair

Dr. Georgia Kosmopoulou

Dr. Shane Connelly

Dr. Dingjing Shi

Dr. Adam Feltz

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Abstract

The literature on creativity has long held that one of the most central processes central to the success of any creative problem-solving endeavor is the gathering of information that is pertinent for task completion, most notably the key facts and anomalies that are at play in the specific creative context. However, previous findings regarding the relationship between distractors and creative performance have been mixed. We review the arguments present in the literature surrounding the potential benefits or drawbacks of distractors for creativity. We then in turn investigate, using an undergraduate sample, the effects of task-relevant or task-irrelevant distractors as well as time pressure on the information gathering process as part of an educational leadership task requiring creative problem-solving. Participants were asked to take on the role of principal at a new experimental high school. These participants were required to read through a wealth of information related to task completion and were then tasked with creating a plan to "achieve academic excellence" in their new experimental high school. Outcomes included amount of information gathered, the extent to which gathered information included key facts and/or anomalies, and the quality, originality, and elegance of final plans. Findings indicate that distractors extend information search, but do not contribute to the gathering of key facts or anomalies. Distractors also did not impact quality, originality, or elegance of creative plans. Implications of these findings for practice and future research are discussed.

Keywords: creativity, distraction, information gathering, problem-solving

Where Was I? Distractions During Information Gathering

One of the most critical activities for any firm to succeed, or even survive, is innovation (Heunks, 1998; Sternberg, 1999). Indeed, the founding of any new firm is typically based in some innovation in technology, process, or market (Schumpeter, 2000; Wong et al., 2005). Innovation in firms has been shown to be related to the life expectancy of the firm (Cefis & Marsili, 2005; Zhang et al., 2018), its ability to survive crises (Naidoo, 2010), and its development and profitability (Howitt and Aghion, 1998; Makri and Scandura, 2010; Scherer 1965).

The activity of innovation, however, has many processes that underlie it. Most notably, innovation involves the development and fielding of something new that is of some value to the relevant stakeholders – whether that takes the form of a product innovation or a process innovation (Damanpour & Aravind, 2012). Although innovation is a detailed phenomenon consisting of various aspects, ultimately innovation can be defined as the successful adoption and implementation of creative ideas within an organization (Amabile, 1998; Scott & Bruce, 1994). Given the practical importance of innovation for the success of any firm, coupled with the inherent link between innovation and creativity, it would thus be important to investigate how creativity occurs within these firms.

Creative Problem-Solving

Stereotypical, common definitions of creativity often evoke images of famous artists and scientists; prodigies that act far outside of the "normal" scope of their domain and produce radical advances or changes in their field. Although these people and their works certainly require creative activity (Feist & Gorman, 1998), it is best to understand at a basic level what

creativity entails specifically (Mumford, 2000). Many early conceptions of creativity looked externally, defining creativity by a pattern of accomplishments and evaluations of work that people commonly held to require creative activity (McClelland, 1961; Simonton, 1984). The specific aspects of these solutions that drive such appraisals was investigated in studies by Besemer and O'Quin (1998) and Christiaans (2002). These investigators found that three dimensions consistently emerged as the attributes that define creative products – quality, originality, and elegance. Mumford and Gustafson (2007) extended these findings to define creative problem-solving as the production of high quality, original, and elegant solutions *to* problems that are novel, complex, and ill-defined.

With the understanding both of what problems require creativity and what creative solutions consist of, the next logical question to ask is how individuals actually work through creative problems – the cognitive processes that underlie creative thought (Dewey, 1910; Isaksen & Parnes, 1985; Merrifield et al., 1962). Although a number of models of creative problem-solving processes have been proposed, the most widely accepted model is the creative process model proposed by Mumford et al. (1991). This model, which has had validity evidence provided by an extensive series of studies (Baughman & Mumford, 1995; Friedrich & Mumford, 2009; Lonergan et al., 2004; Mumford et al, 1996, 1997; Reiter-Palmon et al., 1997; Scott et al., 2005), outlines eight key processing activities that play a role in most incidents of creative problem-solving: 1) problem definition, 2) information gathering, 3) concept/case selection, 4) conceptual combination, 5) idea generation, 6) idea evaluation, 7) implementation planning, and 8) adaptive monitoring. Of these eight processes, certain processes appear to be especially important in certain domains (Mumford et al., 2010). The output of each of these processes was held to provide the basis or input for subsequent processing activities. As such, any errors in

early operations can flow through and impact the effectiveness of later creative processes (Friedrich & Mumford, 2009; Licuanan et al., 2007). Accordingly any disruptors to the performance of these early-stage processes, for instance information gathering, may be of some particular importance for investigation.

Information Gathering

The generation of creative problem solutions to complex, novel, ill-defined problems requires the consideration of what information is pertinent for task completion. As such, the search and encoding of information is held to play an important role for creative thought (Mumford et al., 1996). Indeed, previous studies have provided evidence that creative achievement in the sciences is related to more systematic, extensive, or efficient information gathering (Kulkarni & Simon, 1988; Qin & Simon, 1990). Furthermore, these information searches appear to impact the success of larger organizations in which the creative work is being completed (Kickul & Gundry, 2001).

Various research endeavors have found that more extensive information search is related to creative performance. Studies by Finke et al. (1992), Mumford and Gustafson (1988), and Perkins (1992) support the idea that extended search contributes to creative thought by producing a wider range of information that can be used in subsequent creative problem-solving processes such as concept/case selection and conceptual combination. Moreover, Alissa (1972) suggests that using a wider range of information, even information that is irrelevant to the task, contributes to the production of creative output.

There is research to support the notion that not all information is of equal value, however. It has long been argued that certain kinds of information are more relevant for creative problem-

solving, and that individuals seek out this information using different strategies (Perkins, 1992; Sternberg, 1986). Two types of information that are of particular importance to creative problem-solving are key factual information and anomalous information (Mumford et al., 1996). Both the selective encoding of relevant factual information (Davidson, 1995) and the identification of discrepant information (Dunbar, 1995; Kuhn, 1970) have been shown to be related to creative performance and achievement.

Davidson and Sternberg (1984) have also provided evidence that more creative individuals differ from their less-creative peers in that they are better able to discount irrelevant, distracting information. The notion that only certain types of information (i.e. key facts, anomalies) might be useful for task completion implies that other forms of information may be seen as unnecessary or distracting. Accordingly, it may be important to consider how distractions that occur during information search, distractions that could be either task-relevant or task-irrelevant, might impact creative problem-solving.

Distractors

The creativity and cognition literatures have long examined the potential effects of distractors on creative performance. However, findings from these endeavors have shown mixed results as to whether these distractors are beneficial, detrimental, or unrelated to the generation of creative products. One argument made by researchers is that distractions can foster creativity by promoting divergent thinking. Indeed, Baird et al. (2012) found that distractions facilitate creative problem-solving by allowing the mind to wander. This mind wandering allows individuals to incubate, or unconsciously think about the problem at hand. This incubation, which occurs while distracted, has been shown to lead to more associative and divergent thought (Dijksterhuis & Meurs, 2006). In fact, Zmigrod et al. (2019) found that certain individuals,

specifically those that are more likely to attend to distractors while working, have an advantage for working on creative problems that have some basis in insight. In line with these findings, multiple studies (White & Shah, 2006, 2016) have found that individuals with attention-deficit/hyperactivity disorder (ADHD), who are more susceptible to distractions, outperform their peers without ADHD in creative problem-solving and innovative thinking.

Another argument proposing that distractions can benefit creativity is that they enable experts to broaden their scope of thought beyond their typical experiences. This is supported by research conducted by Amer et al. (2016), which indicates that reduced cognitive control (i.e. the ability to selectively focus attention and inhibit distractions) can offer unique benefits to older adults when it comes to creative problem-solving tasks. In addition, Carpenter et al. (2020) have suggested that older adults' reduced capacity to ignore irrelevant information not only renders them more vulnerable to distraction, but also more inclined to generate creative problem solutions.

On the other hand, there is research to suggest that distractors detract from creative performance. Evidence suggests that distractions, even simply taking the form of background music of any type, impair performance on creative activities (Threadgold et al., 2019). Researchers have theorized that these environmental distractors are the reason why many scientists feel the need to work alone – social needs and activities detract from the work being done (Lovelace, 1986). Indeed, consistently high levels of proximity within teams appears to be detrimental for overall creative performance (Kratzer et al., 2006). It would appear, then, that individuals engaging in creative problem-solving need the space to devote sufficient attentional resources to task completion.

Further research appears to suggest that distractors can detract from creative performance. Findings resulting from a study completed by Hao et al. (2015) indicate that mind wandering during idea generation negatively impacts divergent thinking outcomes. These findings also suggest that individuals engaging in more mind wandering tended to produce ideas of decreasing originality over time. The investigators believe that this is due to the control processes involved in idea generation being impaired by the mind wandering activities. Indeed, both Baron (1986) and Shalley (1995) argue that distractions hurt creative performance as they cause individuals to experience attentional conflict. This in turn restricts the ability of individuals to focus cognitively, causing them to attend only to central cues (such as key facts) and ignore potential peripheral cues (including, perhaps, anomalies). These findings are supported by Boggs and Simon (1968), whose findings indicate that distractors are of particular detriment when individuals are working on complex problems where they have less attentional capacity in reserve.

Further still, there is research that might suggest that the relationship between distractors and creativity is not as clear-cut as purely positive or negative. For instance, Samani et al. (2017) found that environmental distractions have no significant effect at all on creative outcomes. In contrast, Mehta et al. (2012) found that moderate levels of distraction can be beneficial for creative problem-solving, but that greater levels of distraction are detrimental for information processing and thus creative performance. These conflicting findings suggest that the effects of distractors are likely to have differential effects depending on the context of the work and the individuals engaging in said work.

Additional studies point to the varying beneficial nature of distractors. Research endeavors such as the one completed by Vartanian (2009) indicate that creative problem-solving

is best facilitated by varying one's attention level between intentional focus and distraction, suggesting that individuals ought to attend to both the task and distractions to generate the most creative products. These findings are supported by Zabelina (2018), who suggests that benefits of distractors for creativity may come from people that are able to combat distractors by readily switching focus back to the task at hand when necessary. The necessity of attentional control for creativity is best summarized in Frith et al. (2021), who found that a general executive factor significantly predicts divergent thinking originality.

Given the conflicting and mixed arguments for the benefits of distractors for creative problem-solving, the study outlined in this manuscript will set out to discover the potential effects of distractors on creative problem-solving specifically during the information gathering stage of the creative process. We will attempt to find out how these distractions, whether relevant or irrelevant to the task at hand, affect both the amount and types of information gathered by individuals during creative problem-solving as well as their subsequent creative performance. Accordingly, we present the following research questions:

Research Question 1: How might the presence of a distractor during information gathering affect the amount and types of information gathered?

Research Question 2: How might the presence of a distractor during information gathering affect subsequent creative problem-solving performance?

Research Question 3: How might the task-relevance of a distractor during information gathering affect the amount and types of information gathered?

Research Question 4: How might the task-relevance of a distractor during information gathering affect subsequent creative problem-solving performance?

Time Constraints

Another factor that might affect information gathering, especially when distracted, is the presence of a time constraint. Many individuals undertaking creative endeavors, including organizational leaders, are under various pressures at any given point during their work. Some of the most salient examples of these high-pressure situations are in times of crisis. These situations occur suddenly, with very little response time available (Jick & Murray, 1982). Although this adds some element of time pressure for individuals, these crisis situations may actually be beneficial, or even necessary, for certain types of leaders to emerge (Hunt et al., 1999). As such, investigating how leaders perform under these conditions is likely to be of great empirical importance.

Previous studies have also found that time pressure inhibits creative problem-solving performance. The stress that results from time pressure has been found to cause individuals to employ simpler, less effective strategies on creative tasks (De Dreu, 2003; Ordóñez & Benson, 1997). These relatively less effective strategies can inhibit creative process execution which in turn leads to decreased creative performance overall (Amabile et al., 2002; Antes & Mumford, 2009).

Accordingly, with respect to information gathering, we would expect that individuals under conditions of time pressure would have limited ability to gather information, leading in turn to a restricted search. Additionally, it takes time to work through the key facts of a situation, meaning that some pressure on this process might limit the ability to gather this information. Similarly, it is hard to look through discrepant or anomalous information, meaning that time constraints are likely to have salient negative effects for gathering this information as well.

Finally, previous findings have shown that time constraints limit creative problem-solving performance. Accordingly, we present the following hypotheses:

> *Hypothesis 1:* Participants performing under conditions of time pressure will gather less information overall, as well as fewer key facts and anomalies bearing on the task at hand, than participants that are not performing under conditions of time pressure.
>
> *Hypothesis 2:* Participants performing under conditions of time pressure will demonstrate lower levels of creative performance (quality, originality, and elegance) than participants that are not performing under conditions of time pressure.

In addition to the main effects of both distractors and time pressure on information gathering and creative performance outcomes, we intend to investigate the interaction effects between the two manipulations on these outcomes as well. Due to a lack of empirical evidence to support a compelling theoretical argument along these lines, however, we make no formal hypotheses or research questions along these lines and instead intend to investigate any of these potential effects during analysis of our data.

Method

Sample

The participants studied in this effort consisted of 208 undergraduate students attending a large Southwestern university. The sample consisted of 53 males, 153 females, and 2 participants that did not wish to disclose their gender. The average age of the participant sample was 19.03, with a standard deviation of 2.41 years. Participants were recruited through undergraduate psychology courses that offered extra credit for their participation in experimental studies. Individuals seeking to participate in these studies were provided with a brief one-paragraph

description of each available study on a departmental website. Undergraduates interested in participating then selected the study, or studies, that they wished to sign up for.

General Procedures

Participants were recruited to complete an experiment investigating effects on creative problem-solving in an educational leadership domain. The study's informed consent document noted that the study could last between one and two hours for full completion. This study was administered through an online survey platform, and participants were asked to only complete this study on a computer, such as a laptop or desktop. This was done to ensure that participants 1) would have the screen space necessary to read through information quickly, 2) would have the battery required to complete the entirety of the study, and 3) would be able to type their responses quickly on tasks that were timed. Embedded metadata collected automatically through the survey platform was used to remove participants that used a mobile device such as a smartphone or tablet from the study.

The study began with participants completing two timed individual difference covariate measures. Participants then worked through the experimental task for this study. This experimental task involved a low-fidelity simulation exercise in which participants were asked to take on the role of principal, or leader, of a new experimental high school. Participants were provided with material outlining their goals for the task, as well as considerations to take into account while working through the task. Both manipulations for this study were embedded in this information gathering phase. Participants were then asked to list what information, if any, they would use while leading the school. After identifying this information, participants then formulated a plan for how they would structure the functioning of their school. After completing

this task, participants filled out a number of untimed individual difference covariate measures to finish their participation in the study.

Covariate Measures

Based on findings obtained from previous studies of creative problem-solving and leadership performance (Vincent et al., 2002; Zaccaro et al., 2015), the timed covariate measure that participants completed first was a measure of divergent thinking. This measure was included in order to measure the ability of participants to think creatively. The specific divergent thinking measure used in this study was Merrifield et al.'s (1962) Consequences measure. This measure prompts participants to generate novel ideas that might be potential results of unlikely events. For example, one prompt for this measure asks participants to consider "What would be the results if people no longer needed or wanted sleep?" Participants were instructed to generate as many of these consequences as possible for each of five such prompts. A time limit of two minutes was imposed for each prompt (resulting in a total of ten minutes for the overall measure). When this measure is scored for response fluency, operationally defined as the number of consequences generated, this measure typically yields internal consistency coefficients above .70. Evidence supporting both the construct and predictive validity of this divergent thinking measure has been provided by Vincent et al. (2002).

Because this measure asks participants to remember the information that they found to be most salient for the task, the second timed covariate measure was one of working memory. The specific measure of working memory used in this study was Turner and Engle's (1989) operation span (OSPAN) task. This measure presents participants with a series of simple equations, such as "2 + 7 = 6" or "10 – 3 = 7", to which they are asked to quickly respond whether the solution is true or false. After responding to each equation, participants are presented with a word that they

are instructed to remember, such as “toy” or “port”. Participants are then asked, after a set of equation-word pairs are shown, to remember each word presented in the set in the order that they were presented. Forty word-equation pairs are presented in total, separated into ten different sets. Set lengths range from two to six words, and participants are given the opportunity to practice a small set before beginning the actual task. Scores on this task are calculated by summing the length of each set recalled perfectly (i.e. not counting any set in which any word was not correctly remembered). Furthermore, participants that did not correctly respond to at least 80% of the equations were given a score of zero for failing to engage with the task. Alpha coefficients for this measure tend to range at .75 or more (Klein & Fiss, 1999; Waters & Caplan, 2003), with validity evidence being provided by Conway et al. (2002) and Engle et al. (1999).

The first untimed covariate measure presented to participants, after a demographic information form, was a measure of expertise relevant to the task. Many studies have shown that those who provide the most creative problem solutions have a substantial amount of expertise working in the domain at hand (Connelly et al., 2000; Clydesdale, 2006; Ericsson & Charness, 1994; Hunter et al., 2008). Participants were asked to complete Scott et al.’s (2005) background data measure, which presents participants with a set of questions regarding their exposure to and interest in issues surrounding education. Example items include “How likely is it that you will go into education as a career?” and “How much time do you spend thinking about how to make schools better?” Participants responded to these questions on five-point Likert-type scales. Items on this measure yield an internal consistency coefficient above .70. Evidence for the construct and predictive validities of this measure for expertise in educational settings has been provided by Robledo et al. (2012) and Scott et al. (2005).

Based on previous studies investigating the effects of personality dimensions on creative performance (Feist, 2019; Feist & Gorman, 1998), the next untimed covariate measure presented to participants was the Five-Factor Model Questionnaire (FFMQ). This measure is an 80-item inventory developed by Gill and Hodgkinson (2007) to assess the Big Five personality characteristics of extraversion, agreeableness, neuroticism, openness, and conscientiousness. Participants indicated on five-point Likert-type scales the extent to which each of the 80 items, an adjective such as sensitive, punctual, or artistic, reflects their own personality. The resulting 16-item scales for each of these Big Five characteristics yield internal consistency reliabilities above .80. Evidence for the predictive and construct validities of these scales has been provided by Gill and Hodgkinson (2007).

Because the ability to work with numbers is an ability related to the task at hand in this study, participants were asked to complete a short measure of numeracy. The measure used in this endeavor was Fagerlin et al.'s (2007) Subjective Numeracy Scale. This eight-item measure assesses both participants' beliefs about their skill in performing various mathematical operations as well as their preferences regarding the presentation of numerical information. Responses for this measure were provided on five-point Likert-type scales. This measure yields Cronbach's αs of .82, with evidence for the construct and predictive validities of this measure being provided by Fagerlin et al. (2007) and Zikmund-Fisher et al. (2007).

Because the creative problem-solving task included in this study requires participants to think deeply (Watts et al., 2017), the last untimed covariate measure that participants were asked to complete was Cacioppo et al.'s (1984) measure of need for cognition. This 18-item measure asked participants to rate on five-point Likert-type scales their preference for engaging in intellectually stimulating tasks. Example items include "I prefer my life to be filled with puzzles

that I must solve" and "I only think as hard as I have to" (reverse-coded). The scale resulting from these items yields internal consistency coefficients above .80. Evidence supporting the construct validity of this measure has been provided by Cacioppo and Petty (1982) as well as Watts et al. (2017).

Experimental Task

To investigate the effects of our manipulations, participants were asked to engage in a low-fidelity simulation exercise. This task, drawn from Strange and Mumford (2005), required participants to take on the role of principal at a new experimental high school. Prior studies that have used this task have indicated that undergraduate students have the expertise required to perform this task and that they generally find the task to be both engaging and realistic – indicating that they are motivated to take task completion seriously.

As the principal for the new experimental high school, participants were asked to take on the challenge of improving the academic success of the school's student body by creating a new curriculum for the school. In this task, participants were first presented with a description of the high school, which noted that the school was established by the State Department of Education based on funds allocated as part of a national effort to institute experimental secondary schools in each state. The purpose of this national effort was to establish new academic programs that would contribute to the improvement of the student body. At the end of each academic year, school performance was to be assessed and compared to other high schools in the state as well as other newly-established experimental schools in different states. These performance evaluations were to be completed using standardized tests administered in a pre-test, post-test format measuring general educational skills such as mathematical skills, reading comprehension, writing skills, and analytical skills. Furthermore, additional tests would be used to examine student

performance in specific academic content domains including social studies, geography, the sciences, and foreign languages. Participants in this study were informed that the experimental schools with the greatest performance gains would be allotted additional funding in the following academic year and that they would be asked to circulate their curriculum to the other secondary schools in their state. The issues presented in this material were collected from a review of the educational literature that was completed by Scott et al. (2005) and was aimed at identifying the key issues that influence school performance.

After reading through this introductory material, participants were provided with a more in-depth, detailed description of the experimental school specifically as well as the state educational system more generally (see Appendix A). Participants were informed in this material that current issues facing the state's educational system had led to the state's schools being ranked 49th in the nation in terms of school funding and 47th nationally in terms of academic performance. The experimental high school itself was described as having an anticipated enrollment of 400 students drawn from a diverse pool of ethnic groups. Participants were further informed that their teaching method should include programs to help student members of special populations, such as academically disabled and gifted students. Moreover, participants were told that funding for the school would provide enough teachers to have a ratio of one instructor for every 20 students. These teachers were to be paid above-average salaries for their involvement in the experimental school program. Accordingly, participants were informed that they would have the capability to recruit instructors of higher caliber that would be motivated to help the secondary school succeed. Finally, participants were also provided with lists of important issues that were of particular concern to teachers at this school (see Appendix B) and parents of students attending the school (see Appendix C). These issues included a variety of topics such as

graduation rate, socioeconomic status, and purposeful teaching. All of the background information provided, as well as the lists of important issues from stakeholders, served as the information to be gathered by participants for this task – information gathering not done for divergent thinking or expertise, but for creative performance generally.

After reading through this information, participants were asked to list the information that they found to be the most important to consider when leading this school. They were told that this information should be the basis for their plan to lead the organization. After providing this response, participants were asked to formulate, in two to three pages, a plan "to achieve academic excellence" in the new school. They were asked to include any elements such as process improvement ideas, teaching strategies, and special activities or programs that they felt would help the school succeed. This plan, coupled with the previously generated list of important information provided by participants, served as the basis for the dependent variable ratings.

Manipulations

The manipulations of distractors and time pressure were embedded within the experimental task. The distractor manipulation was created by interrupting participants during the information gathering portion of the experimental task. This manipulation had three conditions – no distractor, a task-relevant distractor, and a task-irrelevant distractor. In the no distractor condition, participants were able to gather information without interruption. In both distractor conditions, participants were redirected automatically to a new screen after one minute of gathering information during the task. This new screen presented students with a simulated email from a superintendent asking them to pay special attention to a certain set of issues. In the task-relevant distractor condition, the superintendent asked participants to consider ideas on improving the teaching and processes involved at the school, as well as ideas for programs for

gifted and academically disabled students. In the task-irrelevant distractor condition, the superintendent asked participants to consider ideas on fostering a happy, bright school environment, as well as issues related to a school recycling program. These levels of the manipulation were structured as either relevant or irrelevant based on the information provided to the students, as well as a review of the literature that identified what issues are most important for leading a secondary school (Scott et al., 2005). Thus the relevant distractor was aimed at focusing attention back to the core aspects of the task at hand, whereas the irrelevant distractor was intended to distract participants away from these aspects. After reading through the distractor email, participants were able to return to the information for the task and resume gathering whatever information they found to be relevant for task completion.

The time pressure manipulation was also embedded in the information gathering portion of the experimental task and was created by imposing a time limit on certain participants as they read through the information on the school and the state's education system. In the high time pressure condition, participants were instructed that their time was limited, and the time limit was set to be 30% below the mean time taken to gather information based on a pilot study of undergraduates. In the low time pressure condition, participants were free to gather information for their plan for as long as they wished. This manipulation was drawn from Barrett et al.'s (2011) study and has previously been shown to induce perceptions of time pressure when completing the task.

Dependent Variables

The first set of dependent variables investigated in this study were aimed at assessing the amount and types of information gathered by participants in their role as principal of the experimental secondary school. Lists of information gathered by participants were appraised for

the amount of information gathered, the extent to which gathered information related to the key facts of the task, and the extent to which gathered information related to anomalies – the unique aspects of this specific task that would not be present in similar situations. The amount of gathered information was defined as the number of ideas or concepts outlined by the participant, as well as the level of detail that participants were able to provide for said information. Gathering of key facts was defined as the extent to which participants considered information that made sense for the task, was relevant for task completion, and related to many relevant aspects needed for task completion (examples included staffing of faculty, curriculum, etc.). Gathering of anomalies was defined as the extent to which participants considered information that was related to unique aspects of the task or that was generally unexpected while still being relevant to task completion (examples included ideas of programs for academically gifted students and disabled students, experimental teaching methods, etc.).

The next set of dependent variables was aimed at assessing the performance of participants in providing plans that could be considered viable for their role of principal. Based on the findings of Christiaans (2002) and Mumford et al. (2015), participants' plans were rated on the basis of quality, originality, and elegance. In keeping with similar studies of creative performance (e.g. Dailey & Mumford, 2006; Scott et al., 2005; Vessey et al., 2011), quality was defined as a plan that was useful, coherent, and complete. Furthermore, originality was defined in this study as a plan that was clever and unexpected. Finally, elegance was defined as a plan that was well-written and refined, with each part of the plan flowing well together (Strange & Mumford, 2005).

Each of these ratings were completed by three judges trained in industrial and organizational psychology as well as literature on creativity, leadership, and education. These

raters were asked to evaluate the gathered information and written plans of participants on five-point rating scales. Raters first practiced applying these rating scales to a set of sample experimental products. They afterwards met with each other and the researchers to discuss their ratings relative to the operational definitions of each variable. Any discrepancies between raters were discussed and resolved. Following this training and the rating of each of the variables included in this study, inter-rater reliability coefficients were calculated. These inter-rater reliability coefficients were .86, .79, and .79 for amount of information, gathered key facts, and gathered anomalies, respectively. Inter-rater reliabilities for quality, originality, and elegance were .83, .78, and .80, respectively.

Analyses

A series of analysis of covariance (ANCOVA) tests were used to examine the effects of each manipulation on the outcomes of interest in this study. In each of these analyses, any covariates were retained only if they were significant at the .05 level. Follow-up analyses were conducted for significant main and interaction effects to examine the direction of each effect. Finally, a multivariate analysis of covariance (MANCOVA) was conducted with each covariate, manipulation, and outcome variable included. However, as this MANCOVA ultimately did not provide any additional information of the series of conducted ANCOVAs, these results were excluded from this manuscript.

Results

Table 1 presents the means, standard deviations, and correlations for each outcome measure and covariate. In accordance with past studies of creativity, our measures of creative performance were significantly positively related to working memory, conscientiousness, and

introversion (a significantly negative relationship with extraversion). Notably, two of our information gathering variables, amount of information gathered and key facts gathered, were correlated with a similar pattern of covariates as the creative performance outcomes (including both working memory and introversion). These findings are in line with those of Mumford et al. (1996), which found that attending to key facts and inconsistent information is related to creative problem-solving. As such, these findings point to the construct validity of our measure of information gathering.

Turning to the effects of our manipulations on our information gathering outcome variables, we can look first at the amount of information gathered. Table 2 presents the results of our ANCOVA analyses investigating the effects of distractors, time pressure, and the interaction between the two on this outcome. A main effect of distractors was significant ($F(2, 206) = 4.07$, $p < .05$, $\eta_p^2 = .04$) such that individuals that were distracted, either with a task-relevant ($M = 2.49$, $SD = 1.08$) or task-irrelevant ($M = 2.75$, $SD = 1.23$) distractor, gathered more information than participants that were not distracted ($M = 2.23$, $SD = 1.02$). Pairwise comparisons were conducted and indicated that those that were presented with an irrelevant distractor significantly differed from individuals that were not distracted, but that individuals presented with a task-relevant distractor did not significantly differ from either of the other groups (see Table 3). As can be seen in Table 4 and in Table 5, neither distractors, time pressure, nor their interaction significantly predicted key facts or anomalies gathered.

Next we can turn to the effects of our manipulations on creative performance outcomes. Shown in Table 6 are the ANCOVA results for plan quality. A marginally significant main effect of time pressure on plan quality was seen ($F(1, 207) = 3.24$, $p = .07$, $\eta_p^2 = .02$) such that participants that were not put under time pressure during information gathering generated plans

of higher quality (M = 2.84, SD = 1.10) than participants that were put under time pressure when gathering information (M = 2.60, SD = .99). This pattern can be further seen in our ANCOVA findings for plan originality, shown in Table 7. A significant main effect of time pressure on plan originality was found ($F(1, 207) = 4.88$, $p < .05$, $\eta_p^2 = .02$) such that participants that were not put under time pressure generated more original plans (M = 2.90, SD = 1.19) than participants in the high time pressure condition (M = 2.56, SD = 1.05). Once again, these findings are consistent when we examine the ANCOVA results for plan elegance, seen in Table 8. A marginally significant main effect for time pressure on plan elegance was seen ($F(1, 207) = 3.17$, $p = .08$, $\eta_p^2 = .02$) such that participants that were not put under time pressure generated more elegant plans (M = 2.70, SD = 1.14) than those participants put under time pressure (M = 2.46, SD = .92).

In addition to the analyses outlined above, we performed a median split on both gathered facts and gathered anomalies in order to investigate the effects of these variables on creative performance outcomes. This was done primarily to provide further support for previous studies (i.e. Mumford et al., 1996) that have seen significant effects of gathered facts and gathered anomalies on creative performance. As can be seen in the supplemental ANCOVA analyses presented in Table 9, there was a significant main effect of key facts gathered on plan quality ($F(1, 207) = 22.05$, $p < .001$, $\eta_p^2 = .11$) such that participants that gathered more key facts generated plans of higher quality (M = 3.16, SD = .99) than participants that gathered fewer key facts (M = 2.40, SD = .85). This effect was seen for plan originality as well – as shown in Table 10, there was a significant main effect of gathered key facts ($F(1, 207) = 9.10$, $p < .01$, $\eta_p^2 = .04$) such that participants that gathered a greater number of key facts generated more original plans (M = 3.03, SD = 1.12) than participants that gathered fewer key facts (M = 2.49, SD = 1.01). A further significant main effect for gathered anomalies was seen ($F(1, 207) = 7.37$, $p < .05$, $\eta_p^2 =$

.04) such that participants that gathered more anomalies generated more original plans (M = 3.00, SD = 1.14) than participants that gathered fewer anomalies (M = 2.51, SD = 1.02). Finally, our pattern of results is seen again in the supplemental ANCOVA results for plan elegance, shown in Table 11. A significant main effect of gathered facts on plan elegance was seen (F(1, 207) = 13.96, $p < .001$, $\eta_p^2 = .08$) such that participants that gathered more facts generated plans of greater elegance (M = 2.96, SD = 1.01) than participants that gathered fewer key facts (M = 2.29, SD = .89). There were no significant or marginally significant main effects for either distractors or time pressure on any creative performance outcome resulting from these supplemental analyses.

Discussion

Before we discuss the implications of this study's findings for future research and practical application, a number of limitations should first be taken into account. First among these is that the experimental task used in this study was a low-fidelity simulation exercise. Participants in this experiment had neither the resources nor the time that a principal in a real-world setting would be expected to have in the actual equivalent of this study's experimental environment. It should also be noted that the information gathering portion of this experiment was structured in nature, in that participants were given all of the potential information that they could use for the task at hand up-front and simply needed to select the information that they intended to use. In a higher-fidelity setting, on the other hand, information gathering would be more freed – individuals would seek out and search for information in places where they may not receive anything useful. Furthermore, gathered information and generated plans were obtained from a sample of undergraduate participants. As such, a legitimate question could be asked regarding whether our findings could be generalized to people with more experience and

domain-relevant expertise (Ericsson, 2009). Accordingly, the pattern of findings found in this study might differ from those seen in more practical applications.

Furthermore, it should be noted that this study used only a single experimental task – one focused on educational leadership. As a result, only a single task domain was examined in this endeavor. This limitation should be considered when applying these findings to other domains where individuals might apply different domain expertise. Despite this limitation, it should be recognized that the domain chosen for this study was one that undergraduate participants had some familiarity with, as they had all attended a secondary school in the past. Previous studies by Strange and Mumford (2005), Shipman et al, (2010), and Barrett et al. (2011) have all provided evidence that supports the validity of this task when using undergraduate participant samples specifically.

Moreover, some limitations should be noted with regard to the manipulations used in this study. To begin with, our manipulations occurred in a fixed order and were embedded within the experimental task. The pattern of findings seen here may be inconsistent with those that might be seen if the manipulations were to be ordered differently. Furthermore, the manipulations used in this task may differ significantly from the corresponding conditions that might be seen in more practical creative problem-solving scenarios. For instance, the distractor manipulation used in this study was short in nature, occurred only once, and was either task-relevant or task-irrelevant in nature. In a higher-fidelity setting, distractors are much more likely to occur frequently, take up a significant amount of time, and vary as to their degree of relevance to the creative task. Accordingly, we would hope that future research in this area targets the potential characteristics of distractors might have significant impacts on the various processes that underlie creative problem-solving. Moreover, the nature of our distractor manipulation, even when task-irrelevant,

was still related to the task in some way (i.e. it was still presented as a stakeholder email). As such, participants may not have been completely distracted by this manipulation and may instead have treated it as supplemental information to consider during their information gathering. Higher-fidelity simulations might further consider how distractors that are completely unrelated to the task at hand, including taking a break from the task entirely, might affect creative performance.

Furthermore, this study did not look into potential curvilinear relationships between our manipulations and our outcome variables. For example, we did not compare how varying levels of time pressure might differentially affect information gathering or creative performance. Future research should look at varying the levels of distractors and time pressure even further, especially given previous findings that suggest that moderate versus greater levels of distraction differentially affect creative processes (Mehta et al., 2012).

Finally, it should be taken into account that this study looked at the potential effects of distractors and time pressure on only a single creative process. Accordingly, these findings may or may not hold for other creative processes. For example, distractors during problem definition may cause individuals to consider other alternatives instead of focusing on the goals and procedures relevant to a task. Thus, more random information may keep these people from focusing intently on the aspects of the task, which is of particular importance during this creative process (Csikszentmihalyi & Getzels, 1971). On the other hand, distractors may be beneficial for individuals engaging in the elaboration of emergent features portion of the conceptual combination process, as it may encourage individuals to elaborate in new, different directions (Scott et al., 2005). Further, although we may see a similar pattern of findings from this study for idea generation, as this process is highly driven by application of combined concepts (Finke et

al., 1996), distractors may cause individuals engaging in idea evaluation to consider generated ideas either more or less critically than they would without distraction. Future research should investigate the potential effects of distractors during these creative processes.

This study set out to investigate the extent to which information gathering might be disrupted by distractors. One of the most notable findings from this endeavor involves the pattern of findings seen, and perhaps more importantly not seen, between our distractor manipulation and our outcome variables. Specifically, we found that the presence of a distractor increases the overall amount of information gathered by participants. However, it appears that this extended range of considered information did not involve a greater number of gathered key facts or anomalies, as there was no significant relationship between our distractor manipulation and the gathering of either of these types of information. Instead, it appears that these expanded searches consisted primarily of distally related information that was not salient for the task at hand. This argument is supported by the fact that the relationship between distractor and amount of information gathered was stronger for participants that were exposed to a distractor that was irrelevant to the creative task at hand.

These findings in turn explain the lack of significant findings between our distractor manipulation and creative performance outcomes. Although the distractors did indeed extend information search, it is the number of key facts and anomalies gathered that drives the creativity of problem solutions – effects that provide further support for Mumford et al. (1996). This argument is supported by our supplemental findings that show that participants that gathered more key facts and anomalies produced plans of significantly greater quality, originality, and elegance than participants that gathered fewer key facts and anomalies.

In summary, although distractors may increase information search, they do not ultimately affect information gathering performance as they neither benefit or detract from the gathering of key facts and anomalies. As a result, future research should take into consideration that not all information is of equal value in creative problem-solving. Indeed, extended searches that gather additional information of little relevance will not necessarily lead to products of greater creativity. Instead, the key facts and anomalies that are likely the most salient information for individuals to consider on any creative task will draw individuals' attention immediately and likely will continue to hold these individuals' focus. This argument is supported by our lack of significant findings for a relationship between time pressure and information gathering performance. Put simply, even distracted people, or people put under conditions of time pressure, are able to identify which pieces of information are important. As such, future research on distractors and creativity should realize that "more" does not always lead to "better" in the case of information gathering. Accordingly, future studies of creativity ought to measure the extent to which individuals collect these types of information on creative tasks, rather than the sheer amount of information gathered overall.

These findings provide some good news for people engaging in practical applications of creative problem-solving – the information that is most important for task completion appears to be readily apparent, even under conditions of time pressure or when distracted. As such, individuals operating in crisis situations, on tight deadlines, or on a number of unrelated tasks at once are still likely to identify the key facts and anomalies that are important for the task at hand.

Although this study provides an argument that might put some of the disagreements in the literature on distractors and creativity to rest, there is still a breadth of work to be completed in these areas. First to note here is that replicating the findings seen in this endeavor would be of

some value – especially if any replication efforts were to use different methodological approaches, such as a higher-fidelity simulation, a distinct creative problem-solving task in a domain other than educational leadership, or a repeated or more salient distractor manipulation. Such differences might serve to strengthen the arguments outlined in this piece and provide further evidence for our findings. Alternatively, a new pattern of findings might emerge that brings to light a more detailed or nuanced understanding of the relationship between distractors, information gathering, and creative performance.

Furthermore, future studies of creative performance would do well to investigate how creative problem-solvers compensate for or manage deficits in the gathering of key facts or anomalous information. For instance, there is little to no research examining how individuals, while gathering information, handle situations in which key facts or anomalies are clearly missing. What strategies might these individuals employ to either search further for this information or compensate for their absence? Future research might also investigate how individuals on creative teams work with insufficient information gathered by another member of the team. This next step in the research may be critical given that the most successful creative teams are characterized by substantial communication both within and outside of the team – communication whose primary purpose involves the gathering of important information (Anacona & Caldwell, 1998; Perry-Smith & Shalley, 2003).

Many research endeavors have attempted to discover the true relationship between distractors and creativity. This study attempts to provide a new understanding of the potential effects of such distractors during the creative process of information gathering. Our findings largely suggest that, although distractors expand overall information search, these distractors neither benefit or inhibit the use of the most important information during creative problem-

solving: the key facts and unique anomalies that are critical for creative task completion. Although these findings hope to resolve a number of questions currently under debate in the literature, there are still a great many avenues for future research in this area that have yet to be undertaken.

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Table 1. Descriptive Statistics and Correlations

		M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Amount of Info	2.50	1.14	1																
2.	Key Facts Gathered	2.50	1.02	.92**	1															
3.	Anomalies Gathered	2.19	1.02	.81**	.68**	1														
4.	Quality	2.73	1.06	.54**	.57**	.39**	1													
5.	Originality	2.75	1.14	.50**	.47**	.42**	.76**	1												
6.	Elegance	2.59	1.06	.50**	.53**	.37**	.88**	.76**	1											
7.	Divergent Thinking	5.83	2.21	.00	.02	.01	-.08	-.08	-.11	1										
8.	Working Memory	20.33	10.04	.27**	.29**	.01	.30**	.19**	.27**	.06	1									
9.	Age	19.03	2.41	.08	.07	.05	.02	.06	-.01	-.05	.05	1								
10.	Gender	1.75	.45	.06	.07	.01	.04	-.08	-.03	-.04	.01	-.10	1							
11.	Educational Interest	2.43	.79	.05	.00	.07	.12	.15*	.12	.06	-.03	.01	-.01	1						
12.	Agreeableness	63.78	7.99	-.01	.01	-.04	.01	-.04	-.02	.01	.01	.05	.34**	.03	1					
13.	Conscientiousness	55.28	8.33	.06	.06	.01	.17*	.12	.19**	.05	.04	.12	-.03	-.04	.28**	1				
14.	Openness	53.23	7.66	.06	.01	.12	-.04	-.01	-.06	.17*	.08	.11	-.11	.16*	.13	.06	1			
15.	Extraversion	50.82	10.59	-.21**	-.24**	-.13	-.24**	-.18**	-.20**	.11	-.08	-.03	-.02	.11	.15*	.15*	.20**	1		
16.	Neuroticism	46.75	8.95	.04	-.03	-.03	-.03	.01	-.03	-.08	-.07	-.11	.13	.07	-.12	-.15*	-.06	-.18**	1	
17.	Numeracy	3.26	.85	.10	.02	.02	.14*	.09	.13	.09	.24**	.12	-.34**	.11	-.08	.21**	.11	-.03	-.22**	1
18.	Need for Cognition	53.61	10.30	.14*	.11	.14*	.12	.08	.10	.14*	.077	.19**	-.24**	.25**	-.04	.29**	.44**	.15*	-.14*	.30**

* $p < .05$, ** $p < .01$

Table 2. ANCOVA Results for Amount of Information Gathered

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Covariates						
OSPAN Working Memory**	11.064	1	11.064	9.773	.002	.047
Extraversion*	7.308	1	7.308	6.455	.012	.031
Main Effects						
Distractor*	9.221	2	4.610	4.072	.018	.039
Time Pressure	2.330	1	2.330	2.058	.153	.010
Interactions						
Distractor / Time Pressure	.830	2	.415	.367	.693	.004

* $p < .05$, ** $p < .01$

Table 3. Follow-Up Analyses for Significant Main Effect of Amount of Information Gathered

Distractor	Mean Amount Gathered	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
No distractor	2.234	.123	1.991	2.477
Task-relevant distractor	2.494	.138	2.222	2.766
Task-irrelevant distractor	2.747	.129	2.492	3.002

Distractor	Comparison	Mean Difference	Std. Error	*p*	95% Confidence Interval	
					Lower Bound	Upper Bound
None	Task-relevant	-.3468	.1891	.161	-.7933	.0996
	Task-irrelevant	-.6506**	.1822	.001	-1.081	-.2205
Task-relevant	None	.3468	.1891	.161	-.0996	.7933
	Task-irrelevant	-.3038	.1932	.260	-.7600	.1524
Task-irrelevant	None	.6506**	.1822	.001	.2205	1.081
	Task-relevant	.3038	.1932	.260	-.1524	.7600

* $p < .05$, ** $p < .01$

Table 4. ANCOVA Results for Amount of Key Facts Gathered

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Covariates						
OSPAN Working Memory***	11.233	1	11.233	12.344	.000	.058
Extraversion**	8.974	1	8.974	9.862	.002	.047
Main Effects						
Distractor	4.094	2	2.047	2.249	.108	.022
Time Pressure	1.377	1	1.377	1.514	.220	.008
Interactions						
Distractor / Time Pressure	.833	2	.416	.458	.633	.005

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 5. ANCOVA Results for Amount of Anomalies Gathered

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Main Effects						
Distractor	4.564	2	2.282	2.218	.111	.021
Time Pressure	.505	1	.505	.491	.484	.002
Interactions						
Distractor / Time Pressure	2.818	2	1.409	1.369	.257	.013

Table 6. ANCOVA Results for Plan Quality

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Covariates						
OSPAN Working Memory***	12.077	1	12.077	13.338	.000	.063
Educational Interest**	6.633	1	6.633	7.326	.007	.036
Conscientiousness**	8.671	1	8.671	9.576	.002	.046
Extraversion***	12.629	1	12.629	13.947	.000	.066
Main Effects						
Distractor	2.818	2	1.409	1.556	.214	.015
Time Pressure	2.930	1	2.930	3.236	.074	.016
Interactions						
Distractor / Time Pressure	1.490	2	.745	.823	.441	.008

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 7. ANCOVA Results for Plan Originality

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Covariates						
Educational Interest**	7.790	1	7.790	6.370	.012	.031
Extraversion*	9.746	1	9.746	7.969	.005	.038
Main Effects						
Distractor	.195	2	.098	.080	.923	.001
Time Pressure*	5.967	1	5.967	4.880	.028	.024
Interactions						
Distractor / Time Pressure	4.228	2	2.114	1.729	.180	.017

* $p < .05$, ** $p < .01$

Table 8. ANCOVA Results for Plan Elegance

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Covariates						
OSPAN Working Memory***	10.918	1	10.918	11.740	.000	.056
Educational Interest**	6.972	1	6.972	7.496	.007	.036
Conscientiousness**	10.300	1	10.300	11.075	.001	.053
Extraversion***	11.027	1	11.027	11.857	.000	.056
Main Effects						
Distractor	1.639	2	.820	.881	.416	.009
Time Pressure	2.950	1	2.950	3.172	.076	.016
Interactions						
Distractor / Time Pressure	.619	2	.309	.333	.717	.003

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 9. Supplemental ANCOVA Results for Plan Quality

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Covariates						
OSPAN Working Memory*	4.290	1	4.290	5.497	.020	.030
Educational Interest*	3.738	1	3.738	4.789	.030	.026
Conscientiousness**	5.832	1	5.832	7.474	.007	.040
Extraversion**	6.290	1	6.290	8.060	.005	.043
Main Effects						
Distractor	.046	2	.023	.030	.971	.000
Time Pressure	.148	1	.148	.189	.664	.001
Gathered Facts (Median Split)***	17.207	1	17.207	22.050	.000	.109
Gathered Anomalies (Median Split)	.433	1	.433	.555	.457	.003
Interactions						
Distractor / Time Pressure	.979	2	.490	.628	.535	.007
Distractor / Facts	.953	2	.477	.611	.544	.007
Distractor / Anomalies	.412	2	.206	.264	.768	.003
Time Pressure / Facts	.711	1	.711	.911	.341	.005
Time Pressure / Anomalies	.382	1	.382	.490	.485	.003
Facts / Anomalies	.186	1	.186	.238	.626	.001
Distractor / Time Pressure / Facts	.277	2	.139	.178	.838	.002
Distractor / Time Pressure / Anomalies	2.390	2	1.195	1.531	.219	.017
Distractor / Facts / Anomalies	.837	2	.418	.536	.586	.006
Time Pressure / Facts / Anomalies	1.407	1	1.407	1.803	.181	.010
Distractor / Time Pressure / Facts / Anomalies	.304	2	.152	.195	.823	.002

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 10. Supplemental ANCOVA Results for Plan Originality

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Covariates						
Extraversion*	6.167	1	6.167	5.638	.019	.030
Main Effects						
Distractor	2.159	2	1.080	.987	.375	.011
Time Pressure	.916	1	.916	.838	.361	.005
Gathered Facts (Median Split)**	9.104	1	9.104	8.323	.004	.044
Gathered Anomalies (Median Split)*	7.370	1	7.370	6.738	.010	.036
Interactions						
Distractor / Time Pressure	3.927	2	1.963	1.795	.169	.019
Distractor / Facts	3.554	2	1.777	1.625	.200	.017
Distractor / Anomalies	3.071	2	1.536	1.404	.248	.015
Time Pressure / Facts	.147	1	.147	.134	.714	.001
Time Pressure / Anomalies	.030	1	.030	.028	.868	.000
Facts / Anomalies	.361	1	.361	.330	.566	.002
Distractor / Time Pressure / Facts	.342	2	.171	.156	.855	.002
Distractor / Time Pressure / Anomalies	2.070	2	1.035	.946	.390	.010
Distractor / Facts / Anomalies	.788	2	.394	.360	.698	.004
Time Pressure / Facts / Anomalies	.766	1	.766	.700	.404	.004
Distractor / Time Pressure / Facts / Anomalies	5.110	2	2.555	2.336	.100	.025

* $p < .05$, ** $p < .01$

Table 11. Supplemental ANCOVA Results for Plan Elegance

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Covariates						
Conscientiousness**	7.750	1	7.750	9.136	.003	.048
Extraversion**	5.920	1	5.920	6.978	.009	.037
Main Effects						
Distractor	.170	2	.085	.100	.905	.001
Time Pressure	.578	1	.578	.682	.410	.004
Gathered Facts (Median Split)***	13.956	1	13.956	16.451	.000	.083
Gathered Anomalies (Median Split)	2.113	1	2.113	2.491	.116	.014
Interactions						
Distractor / Time Pressure	2.174	2	1.087	1.281	.280	.014
Distractor / Facts	3.679	2	1.840	2.169	.117	.023
Distractor / Anomalies	.887	2	.444	.523	.594	.006
Time Pressure / Facts	.441	1	.441	.520	.472	.003
Time Pressure / Anomalies	.000	1	.000	.000	.983	.000
Facts / Anomalies	.074	1	.074	.088	.767	.000
Distractor / Time Pressure / Facts	.811	2	.406	.478	.621	.005
Distractor / Time Pressure / Anomalies	2.390	2	1.195	1.531	.219	.017
Distractor / Facts / Anomalies	.151	2	.075	.089	.915	.001
Time Pressure / Facts / Anomalies	.720	1	.720	.848	.358	.005
Distractor / Time Pressure / Facts / Anomalies	3.401	2	1.701	2.005	.138	.022

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix A

General Information Provided to Participants

"Oklahoma Excel" High School

You have been appointed as the Principal of the state's experimental school in Tulsa, Oklahoma called "Oklahoma Excel." The school is part of a national study to increase achievement in schools in the United States. Funding for the Oklahoma Excel School will be allotted in accordance with a federal grant distributed by the National Education Agency to each State Department of Education. Each state is awarded funding for one experimental school, and Tulsa's Oklahoma Excel School is Oklahoma's representation in the national study. The goal of each experimental state school is to develop and implement a new type of educational program that increases students' academic performance. At the end of the 2020-2021 school year, Oklahoma Excel will be evaluated in reference to the students of the other states' experimental schools as well as in relation to the students of traditional Oklahoma public schools.

Program Evaluation

This evaluation of the students in the experimental schools will be based on improvement of the students in the schools. Each student will take a pre-test over material selected by the National Education Agency at the beginning of the school year. This will assess the increases in academic performance for each experimental school. These tests will be administered in all of the experimental schools, and the improvement scores will be compared across students of all the states. The material on the test will be benchmarked by the National Standards of Education General Guidelines (for example, all students should read grade level). The evaluation of Oklahoma Excel students compared to other students in Oklahoma will be based on scores of the Oklahoma Standardized Test. All students in Oklahoma are required to take this test, and the material covered on it is general. It assesses writing skills, reading comprehension, mathematic skills, and analytical skills. There are also subtests on sciences, social studies, geography and a foreign language component that assesses fluency. This test is essentially how Oklahoma Excel students are compared to students in traditional schools in Oklahoma. After these comparisons to other states' experimental schools and other Oklahoma traditional public schools, the National Education Agency will rank the most successful states in terms of experimental school accomplishment. The states with the most successful experimental schools will receive additional federal funding for the next school year in order to spread the new curriculum around the state for comprehensive state scholastic improvement.

Current Situation

Therefore, the Oklahoma State Board of Education is hopeful for dramatic improvements of students in your Oklahoma Excel School. You are feeling additional motivation for success because, last year, students in Oklahoma Public Schools ranked 47th nationally in academic performance on Standardized Tests. The state is also currently ranked 49th in funding for education. With these poor rankings in mind, you are determined to give students at Oklahoma Excel the best chance at success. Doing so would lead to exciting effects in Oklahoma and increase our state's national standing. Oklahoma Excel will be a **High School** with students of **grades 9-12**. You have a projected enrollment of 400 students from varied ethnic backgrounds (73% Caucasian, 13% Native American, 10% African American, 3% Hispanic, and 1% Other). Also, a principle concern of yours will be to make sure that your teaching method helps members of special populations, including gifted students and academically disabled students. Since the State Department of Education is so interested in Oklahoma Excel, it is willing to provide maximum support. This includes providing enough teachers for a 20:1 ratio of students to instructors. Also, they are willing to pay the teachers above average salaries. Because of these optimal teaching conditions, you will be able to recruit high-caliber instructors who are motivated to make your school a success. One problem the school currently faces is a lack of specialized education programs for students in special populations (i.e. gifted students and academically disabled students). In fact, several unsatisfied parents have opted for their children to attend other schools in the district due to a lack of education that tailors to their child's needs. In addition to unsatisfied parents, there has been a high level of turnover for teachers. Reasons for quitting have been reported to be due to the lack of opportunities for teachers to develop professionally and intellectually, burnout, low levels of autonomy in deciding the teaching curriculum, and an overall general reports of low job satisfaction. In short, the school suffers from both unsatisfied teachers and unsatisfied parents. Therefore, in addition to improved test scores, teacher and parent satisfaction with the program will also be assessed to evaluate the success of your program.

Appendix B

List of Important Issues from Teachers

Academic Emphasis
Definition: Level of expectation and emphasis on student learning; teacher collegiality in the planning of teaching and learning.
Importance: High academic emphasis challenges students to work harder and be better students.

Behavior
Definition: Student Conduct.
Importance: Bad behavior would call attention away from other important school functions.

Classroom Climate
Definition: A good classroom environment helps foster good relationships and satisfaction.
Importance: The better class climate is, the more students tend to engage in class activities.

Resources
Definition: Financial resources and favorable working conditions.
Importance: More resources allow the school to accommodate more students.

School Climate (School Culture)
Definition: How orderly a school is and how well relationships are formed within the school and the satisfaction this brings to staff and students.
Importance: More orderly climates help students stay on task.

Self-Esteem
Definition: Student's value and opinion of oneself.
Importance: Students with higher self-esteem are more able to tackle problems that may arise.

Student Characteristics
Definition: Examples of this are student motivation, drive, and intelligence.
Importance: Different student characteristics can influence their ability to learn.

Teacher Characteristics
Definition: Teacher motivation, training, experience, salaries, etc.
Importance: Teacher characteristics influence their ability to teach and perform to the standards of the school.

Clear Goals
Definition: Does setting specific goals and staff agreement on those goals improve school?
Importance: Goal clarity can improve student focus.

Monitoring Progress
Definition: Consistent/constant monitoring of student/school progress.
Importance: Better monitoring means less likelihood of the school/students straying down the wrong path or growing stagnant.

Professional Development/ Learning Organization
Definition: Continuous learning on part of staff to increase school output.
Importance: A good continuous learning program will make the school more productive.

Parent-Community Involvement
Definition: Teacher interactions with parents and community.
Importance: If everyone feels involved, everyone is invested in the outcomes and will want the students to succeed more.

Professional Leadership
Definition: Staff participation in discussion and decision making, and clear leadership vision.
Importance: Better leadership will create student confidence in the school system.

Purposeful Teaching (Adaptive teaching)
Definition: Figuring out the best way to teach and utilizing such methods in the appropriate situation.
Importance: It is better to tailor teaching programs around the needs of students.

Attendance
Definition: Are more students attending school?
Importance: More attendance shows high student satisfaction with school.

Disciplinary Actions
Definition: Are there less student disciplinary problems?
Importance: Less disciplinary problems allow the school to focus on improving the school

Graduation Rate
Definition: Are more students graduating?
Importance: More students graduating shows that more have mastered the material.

Parental Satisfaction
Definition: Are parents satisfied with student/school progress?
Importance: More satisfied parents are more likely to support the school.

School Quality
Definition: Are there changes in the quality of the school.
Importance: Changes in school quality are indicative of an effective reform.

Appendix C

List of Important Issues from Parents

Process Oriented
Definition: Less focus on actual achievement and more focus on individual processes.
Importance: Students may have different definitions of "achievement". Let each student define success by how they handle problems, rather than what was actually achieved. This prevents students from feeling defeated.

Parental Involvement
Definition: Parents participate in schools more often.
Importance: More parental involvement makes students feel better about the school.

Diverse Socio-economic Status (SES)
Definition: Many different ethnic and financial backgrounds.
Importance: Students will learn to be more open-minded when surrounded by children of different ethnic and financial backgrounds, as opposed to those with similar backgrounds.

Student Autonomy in Class
Definition: A teacher would give students more leeway in their choice of activities after each lecture, rather than lecturing and giving every student the same exercise.
Importance: When students are given autonomy in their choice of exercises, it allows them to choose activities that interest them, which increases their motivation.

Rate of Graduates who go to college
Definition: This is the percentage of individuals who graduate from high school and go to college.
Importance: Preparing all students to receive at least a bachelor's degree, and aiming for 100% of graduates go directly to college will improve the perceived quality of the school and increase public funding.

Advanced Education for Teachers
Definition: Teacher development program that allows teachers get an advanced education and obtain a tenured position at the school.
Importance: This ensures all teachers are highly educated and giving them a sense of job security will increase their performance.

Larger Class Size
Definition: How does (altering) class size impact student performance?
Importance: Larger classes are better for student interaction.