AN ABSTRACT OF THE THESIS OF

Jessica A. Wilson for the Master of Science

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This study investigated the effects of creative examples, ordinary examples, and no examples on creative performance. Participants were 102 9th, 10th, and 11th grade students from a Midwestern high school. Participants were divided into three groups and presented with a creative drawing task. Each group was shown either creative, ordinary, or no examples of solutions to the stated task prior to beginning their own drawing. Three judges scored each product independently using a novelty rating scale. Results indicated that participants who were exposed to creative examples before the task produced drawings judged to be more creative than participants exposed to ordinary and no examples. Specifically, drawings produced in the creative examples group were significantly more creative than drawings from the ordinary example group. This suggests showing examples before a task has both facilitating and constraining effects on creative performance. No gender differences were found for creative performance.

INVESTIGATION OF THE EFFECT OF CREATIVE EXAMPLES ON PERFORMANCE

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Jessica A. Wilson

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CHAPTER 1

INTRODUCTION

Creativity has always been an important, yet elusive concept. The demand for creativity is demonstrated by the ongoing quest of individuals and organizations to discover means of enhancing it's development. Its value in our society is illustrated by the number of well-attended workshops geared toward increasing creativity. The amount of money spent by parents on items that advertise the capacity to facilitate creativity indicates a belief that the environment plays a part in its stimulation. In addition, activities are offered through schools that reward students who demonstrate the ability to produce a product that is judged to be creative. For example, an extracurricular activity offered at many schools (e.g., Odyssey of the Mind) encourages students to prepare for and compete in a "creative olympics." During contests, degree of creativity is judged and rewarded with medals, scholarships, or even advancement to an international level of competition.

When one considers the many positive things that have been associated with creativity (i.e., openness to new experience, cognitive flexibility, problem-solving skills, intelligence, good self-concept, and mental health), it seems important that professionals do what they can to provide an environment that facilitates creativity. To address this issue the present study proposes that creativity can be fostered by the immediate, physical environment individuals experience. This line of research may offer professionals insight into the direct influence they can have on an individual's creative output by way of environmental engineering. Creativity in general, creative cognition, and factors that influence the production of novel products will be discussed in the following text. More specifically, the effect examples may have on the novelty of a product will be considered.

The Study of Creativity

Most literature credits renewed interest in creativity among psychologists to J. P. Guilford's presidential address to the American Psychological Association over 50 years ago (Guilford, 1950). In his address he challenged psychologists to pay better attention to what he thought to be a remarkably important, yet neglected attribute, namely, creativity. Guilford pointed out that the rarity of individuals such as Einstein, Beethoven, and Michelangelo had restricted efforts to understand creativity. He proposed that creativity could be studied using a psychometric approach, such as divergent thinking tasks (Sternberg & Lubart, 1996). Divergent thinking involves fluency (ability to generate a great quantity of ideas), flexibility (ability to switch from one perspective to another), and originality when picking unusual associations of ideas. These dimensions of thinking are what most tests of creativity intend to measure (Csikszentmihalyi, 1996).

Immediately following the address was a large increase in books, articles, and tests devoted to defining, measuring, and enhancing creativity. However, the empirical work in response to Guilford's call was short lived. In fact, Sternberg and Lubart (1996) ran an analysis that indicated only " one half of one percent of the articles indexed in Psychological Abstracts from 1977 to 1994 concerned creativity" (p. 678). Much of the effort behind earlier publications was directed toward answering the question, "What is creativity?" (Csikszentmihalyi, 1988). Due to these efforts, the concept of creativity defies precise definition (Sternberg, 1988; Torrance, 1988).

Most recently, researchers and theorists have begun to look beyond the source of creativity due solely to individual drives, desires, personality traits, efforts, and interpretations. As a result, more complete frameworks for the study of creativity have been proposed that incorporate the environment, cognitive processes, intelligence, and motivation (Csikszentmihalyi, 1988; Finke, Ward, & Smith, 1992; Hennessey and Amabile, 1988; Langley & Jones, 1988; Sternberg, 1988). In these most current perspectives, creativity and creative products are considered in a context of already existing circumstances that bear upon, and to a degree control, the processes of creativity (Csikszentmihalyi, 1996; Feldman, Csikszentmihalyi, & Gardner, 1994). For example, after years of studying creativity, Csikszentmihalyi (1988) came to the conclusion that creativity is never the result of individual action in isolation, but is the product of three main shaping forces: 1) a set of social institutions, or field, that selects from the work of individuals whose variations are worth preserving, 2) a stable cultural domain that will preserve and pass on the selected ideas to following generations, and 3) the individual, who brings about some change in the domain that the field considers creative.

Weisberg (1988) discussed assumptions of research that seek to understand problem solving and creative thinking as it relates to problem solving. The first assumption is that attempts to solve problems are based on past experience (Murphy & Allopenna, 1994). Second, novel solutions to problems happen in an incremental fashion; one gradually moves or "evolves" away from the concept with which one began (Heit, 1992; Spalding & Ross, 1994). The third implication is that the incremental process just mentioned is set in motion by feedback from the environment concerning the appropriateness of some proposed solution (Weisberg, 1995). The final assumption discussed by Weisberg (1988) is that if all solutions to problems are "creative," so long as they are novel and meet the demands of the problem, then the ability to think creatively must be a basic human capacity (p. 153).

In addition, it has been demonstrated that the ability to think creatively tends not vary due to gender (Baer, 1991). In fact, gender differences in both divergent-thinking tests and in consensual assessment of creative products have tended to be rare (Baer, 1998). However, other data suggests that by manipulating the environment (e.g., expecting evaluation and motivational constraints) significant differences in creative performance can be noted between the genders (Baer, 1997).

Cognition

One current and innovative approach to the study of creativity does consider environmental influences and suggests that creativity be conceptualized as combinations and patterns of the same cognitive processes that occur in non-creative endeavors (Smith, Ward, & Finke, 1995). Cognition is defined as being concerned with the ways individuals obtain, organize, process, store, and use information (Cropley, 1999). It is implied, then, that one can learn more about creative processes by examining concepts of cognition (i.e., category knowledge and structure, effect of prior knowledge on learning new material, fixation, etc.) in creative contexts. For example, research on how creative thinking is inhibited by prior examples may stimulate new ideas about how non-creative thinking is inhibited.

Bruner (1973) has addressed the organization of cognitive material and describes two ways in which, by categorizing, an individual goes beyond presented information.

The first is by recognition of an object and the second is by placing an object in a category. By doing these two things a person processes similarities between an object and category members, and also develops an entire set of inferences about the object which go beyond the immediate information. In a related discussion, Ward (1995) noted four general principles that govern categorization. The first is that people generally agree on the attributes that are characteristic of typical category members (Ashcraft, 1978; Tversky & Hemenway, 1984). The second principle is that the typicality of category exemplars can vary with context (Tversky & Hemenway, 1984). Third, people are sensitive to correlations between attributes (Ward, 1995). Finally, based on general principles of categorization, we could assume that much of categorization is guided by schemas developed through past experiences that each individual holds about the workings of the world (Allen & Brooks, 1991). Once the general knowledge structure (i.e., schema) for a category is constructed, it has a great influence on how presented exemplars are processed and has been shown to result in less attention paid to the individual features of the specific exemplar (Murphy & Allopenna, 1994). Simply put, people tend to manipulate new information to fit their existing concepts (Mayer, 1992; Ward, 1995).

Use of prior knowledge in the development of new ideas has been termed structured imagination (Marsh et al., 1996; Pavlik, 1997; Ward, 1994, 1995). Structured imagination takes into account that ideas do not develop in a vacuum but rely on some type of stored information. New ideas or solutions are predictably structured by the properties of existing categories and concepts (Heit, 1994; Marsh, Bink, & Hicks, 1999; Marsh, Landau, & Hicks, 1996; Ross, 1987; Spalding & Ross, 1994). New ideas appear to be influenced by the properties of existing categories and concepts across all degrees of creativity, from inventors to people who daydream (Ward, 1995). Imagination is structured or guided by knowledge of the category or categories most related to the individual's goals (Ward, 1994; see Heit, 1994 for further discussion regarding models of categorization and the effects prior knowledge has on category learning).

Further, people can infer features of a stimulus by retrieving similar instances from memory (Bruner, 1973; Heit, 1992; Tversky & Hemenway, 1984). For example, Bredart, Ward, and Marczewski (1998) found that when participants drew the face of the most imaginative extraterrestrial creature, a majority projected the surface features and functions of human faces onto their creations. Ward (1994) produced similar results and concluded that even the novel creations of highly imaginative individuals appear to be constrained by certain basic properties that are characteristic of known categories.

That new and novel ideas cannot be completely separated from previous experiences and familiar ideas has been discussed by a number of authors (e.g., Bowers, Farvolden, & Mermigis, 1995; Mandler, 1995; Ward & Sifonis, 1997). The influence prior knowledge has on the development of new categories, and thus exemplar generation, can be both positive and negative. One negative aspect has been termed cognitive "set" (Cropley, 1999). Adamson and Taylor (1954) define the concept of "set" as a continued attempt to use a previously successful method in problems where the method is no longer adequate (p.122). Weisberg (1995) illustrated how "set" may negatively impact problem solving by describing how participants were more apt to use a complex solution given previously even when a simpler solution to later problems should have been obvious. Allen and Brooks (1991) concluded from results of their research that prior exposure to examples affected (in this case impaired) participants' ability to classify the creatures correctly. Another concept related to "set" is "fixedness," which is a mental block due to the association of an object or feature with a particular function (Adamson & Taylor, 1954).

Studies have demonstrated that cognitive set and/or fixedness affects problem solving performance negatively in regard to number of solutions generated and time required to reach a solution (Adamson, 1952; Adamson & Taylor, 1954), and degree of relatedness (Smith & Blackenship, 1991). Considering these results, it seems evident that presenting examples related to the task could prevent individuals from thinking beyond the given examples. However, results of a study conducted by Ross, Ryan, and Tenpenny (1989) indicate an opposite effect. Considering the research presented, a consensus has not been reached regarding whether examples presented before a task affect performance in a positive or negative way.

Creative Cognition

In recent years there has been an increased amount of activity concerned with creativity as influenced and explained by cognition (e.g., Allen & Brooks, 1991; Ellis & Hunt, 1993; Mumford & Gustafson, 1988). As discussed in the previous section, cognition can be defined as the ways individuals obtain, organize, process, store, and use information (Cropley, 1999). Cognition has been shown to influence creativity through the way individuals structure categories using previous knowledge, how prior knowledge affects learning, the phenomena of set or fixation, and how inferences about an unfamiliar object are developed. Because the nature of creativity differs markedly depending on the definition (Mumford & Gustafson, 1988), it is necessary to specifically distinguish the level at which creativity is currently being defined.

The cognitive definition of creativity includes the processes involved in producing effective novelty, the control mechanisms that regulate novelty production, and the structures that result (Cropley, 1999; Finke et al., 1992). Mandler (1995) describes a creative act as the production of something novel which exists in a social context that defines the degree of novelty (p. 10). In 1984 it was reported that criteria used in 48% of creativity studies sampling adult/college students and 13% of studies sampling elementary/secondary students used creative products and behavior as measures of creativity (Torrance & Presbury, 1984).

In alignment with the terminology and concepts of the cognitive perspective, "generative thinking" was used in the present study to describe the development of novel examples of existing concepts (Bredart et al., 1998; Ward, 1997). A generative thinking task requires that participants cognitively engage in devising novel products (Marsh et al., 1999). The ability to construct novel entities requires an ability to go beyond past experience and produce something new in response to the demands of a problem; this has also been termed "productive thinking" (Weisberg, 1995). Products which are a result of generative or productive thinking must resemble what has come before them to the extent that they can be recognized. But, in order to be considered novel creations, they must deviate from the norm in some way. Thus, novel ideas and products generally combine old and new properties (Ward, 1997).

Ward (1994, 1995) has used generative thinking tasks and a cognitive explanation for creativity in much of his research. Looking to the results of his work, Ward (1994) has set forth a tentative explanation for the processes used to produce novelty. The proposed idea is called the path of least resistance and implies that individuals imagining a new entity will initially determine that a particular knowledge domain is applicable, and then will access information from that domain to construct a novel instance. Simply, it is hypothesized that a specific exemplar is retrieved from a relevant domain and the new creation is patterned after that entity. To be considered a novel creation, some significant variation must be incorporated into the final product.

Inherent in the paradigm is the idea that concepts people have about objects are productive structures that can support the generation of novel entities (Bredart et al., 1998). This paradigm, along with many of the concepts discussed regarding creative cognition have proven useful in a number of studies in which individuals are asked to generate novel exemplars of a given concept (Bredart et al., 1998; Pavlik, 1997; Smith, Ward, & Schumacher, 1993; Ward, 1994).

<u>How Context Affects Creative Performance</u>

Many studies have attempted to identify factors in the environment that directly affect creative performance. In fact, much of the research on creativity and problem solving does suggest that performance is a function of the conditions under which responses occur (Wakefield, 1985). Efforts have included focus on factors such as arousal produced by uncertainty (Cropley, 1999), emotional state (Hinton, 1968; Puccio, Talbot, & Joniak, 1993), expected evaluation (Amabile, 1983), type of instructions used to define the task (Ward & Sifonis, 1997), stage of development (Dacy, 1989; Karmiloff-Smith, 1990), and hints (Burke, Maier, & Hoffman, 1966; Maier & Burke, 1967).

The environmental context can provide stimulation which assists with idea formation by "jump starting" a person's thinking processes. In addition, by establishing criteria, the environment sets standards for creative products that individuals may come to internalize as part of their cognitive processes (Lubart & Sternberg, 1995). However, as addressed previously, factors present in the environment may also act as constraints on creative output (i.e., set, functional fixedness, conformity effect, etc.). For example, Ward (1994) believes his research demonstrates that when a person relies exclusively on specific instances (i.e., examples), they may become fixated on its properties. When fixation occurs, the outcome is often workable, yet not an optimal solution. Other research efforts have reported results which have led to similar conclusions (Marsh et al., 1999; Mednick, 1962; Smith et al., 1993).

Mumford and Gustafson (1988) discussed climatic considerations in more general terms and suggested that somewhat different contingencies might be in order depending on the type of creativity one wishes to encourage. They wrote that "when minor contributions are of concern, a climate characterized by well-defined goals and challenging but not impossible expectations seems desirable" (p. 38). The authors also hypothesize that making sure that an individual has a firm grasp of relevant understandings and information may also facilitate application of existing knowledge structures.

Effect of Examples on Solutions

Ways in which examples affect solutions or products have been discussed in terms of the theoretical construct of structured imagination (Bredart et al., 1998; Ward, 1994, 1997), type of task (Ward & Sifonis, 1997), and constraints (Adamson & Taylor, 1954; Ross et al., 1989; Smith & Blackenship, 1991). It has been demonstrated by the studies presented thus far and reiterated by Marsh et al. (1999) that providing participants with additional information through examples very likely changes how a generative task is approached.

In experiments that investigated the access and use of examples, results indicate that more often than not individuals use details of earlier examples when addressing current tasks (Bredart et al., 1998; Marsh et al., 1996; Ross, 1987; Smith et al., 1993; Ward & Sifonis, 1997). In fact, novel creations must share certain properties with prior instances and that using existing concepts allows convenient development of new ideas (Ward & Sifonis, 1997). However, prior experiences could bias the production of new ideas and actually cause ideas to be less novel or original (Smith et al., 1993). This constraint on creative idea generation due to prior experiences has been termed "conformity effect" (Marsh et al., 1999).

Three experiments conducted by Smith et al. (1993) appear to support the hypothesis that conformity, induced by introducing examples, can constrain the generation of creative ideas. In all three experiments subjects' creative ideas tended to conform to the examples shown prior to the creative generation task. In fact, conformity may be caused by unintentional memory for the examples, not by subjects' assumptions that they should try to conform to the examples (Smith et al., 1993). It should be noted that this idea of unintentional plagiarism has been addressed in additional studies and has been termed "cryptomnesia" (Brown & Murphy, 1989; Marsh & Bower, 1993; Marsh et al., 1997)

Ward and Sifonis (1997) acknowledged a conformity effect in their study and suggested that it may be a fundamental characteristic of generative thinking. Specifically, it is possible that some properties are central enough to various concepts that new ideas generated around those concepts are heavily weighted by the concept's central properties, even when people try to be original (e.g., Bredart et al., 1998; Rubin & Kontis, 1983). Marsh et al. (1999) proposed that conformity to experimenter-provided examples suggests individuals use recently experienced information, whereas conformity to familiar attributes (i.e., animals) suggests the use of more long-standing knowledge. So, regardless of the source (experimenter-provided or self-generated), activated information is incorporated into people's novel productions and can lead to conformity.

The inclusion of activated information does not always constrain creativity (Marsh et al., 1996). Marsh et al. (1996) challenged the idea that the conformity effect was constraining by pointing out that if people in Smith et al.'s (1993) example conditions designed creatures that had a larger number of features other than the critical ones used as measurement against controls, the examples could have facilitated more elaborate designs and subsequently enhanced creativity.

Marsh et al. (1996) investigated the above idea by considering remaining features in order to find out whether novel or more common features were excluded from products when examples were shown. They found that creativity measured by total output or elaborativeness of design did not vary with number of examples shown. Also, as the number of examples people were shown increased, so did people's tendency to integrate common features of the examples into their own products.

At face value, these findings would suggest a constraint on creativity; however, constraint does seem to be isolated to the participant's tendency to include more common features, not to exclude more novel or uncommon features. In fact, further analysis showed that the example condition had the highest creativity rating. This finding indicates that "primed" experimental participants in the artificial condition were viewed as more creative by independent raters than control participants (Marsh et al., 1996).

Considering the evidence presented in this review, it is clear that a delicate balance exists between the facilitory effects of providing examples and the cognitive fixation or constraining effects examples may have on creativity (Marsh et al., 1996). In regard to this uncertain balance, Ward and Sifonis (1997) rationalized further study of the effects of examples on performance by addressing methodology and practicality:

> From a methodological standpoint, it is essential to know how different experimental conditions influence performance. From a practical standpoint, any given situation may involve constraints that limit people's tendency to develop highly novel, original ideas.... Assessing experimental conditions that lead to higher or lower levels of originality can provide clues about the most effective means of overcoming constraints and enhancing real world creative functioning. (p. 250)

Summary

Cognitive processes involved in the production of novelty include categorization, divergent thinking, and exploring new implications of structures. When asked to generate a creative product, it is assumed that people utilize these and other cognitive processes. Participants who are presented with a task, instructed to produce novel or creative solutions, and then shown relevant examples may experience creative constraint due to cognitive set or fixedness, which is a tendency to view the world in a fixed way. Some researchers have found participants incorporate features of the examples into their own product and conclude that this is evidence creativity is constrained by conformity to the examples. However, other researchers have challenged this conclusion citing results that demonstrate novelty is not excluded when examples are presented. While common features may, in fact, increase for groups shown examples, so do instances of novelty, which has been shown to raise the product's overall rating for creativity. It seems logical then, considering the information presented, to recognize that conformity may not necessarily be a constraint in all instances.

In the reported study, individuals were asked to generate novel exemplars of a given concept. Three groups were established. One group was given a task that directed participants to think beyond already established mental categories and to be creative, then they were given time to produce exemplars of the given category (i.e., underwater sea creature). Another group was presented with the same task and then shown examples that were ordinary (i.e., not creative) before they began producing exemplars. The third group was presented with the task, shown examples that were creative, and then began work producing exemplars of the given category. Creativity of a given product was defined as amount of novelty present in the product as judged by three independent raters against a feature checklist (Appendix A).

Hypotheses

The present study investigated the following hypotheses:

Hypothesis 1: Novelty scores for the creative example group would be significantly higher than scores of participants in the ordinary and no example conditions.

Hypothesis 2: There would be no significant difference in novelty scores across conditions between male and female participants.

CHAPTER 2

METHOD

Participants

The sample for the present study was 102 Midwestern high school students (i.e., ninth, tenth, and eleventh graders). The sample consisted of an approximately equal number of male and female adolescents. Students identified as gifted or who were enrolled in special education classes (i.e., meet criteria for classification as mentally retarded) were excluded from the sample. Participants who made up the sample were part of several high school classes and received extra credit for participating in the study. The participants were divided into three groups. One group was not shown examples (n = 16 male, 15 female), one group was shown examples considered "typical" (n = 19 male, 13 female), and one group was shown "novel" examples (n = 24 male, 15 female). Already existing classes were considered clusters and the study was conducted during regular class time as arranged by the examiner and classroom teachers.

Experimental Design

In this study, a quasi-experimental design was used. The quasi-experimental design was used because random selection and assignment of subjects to treatment groups was not feasible. Because the study took place during a school day, treatment conditions were assigned to already existing classes and students participated during their scheduled class period. Each intact class was randomly assigned to a treatment condition.

Three treatment groups were established: no example group, ordinary example group, and a creative example group. The three treatment conditions were considered one independent variable due to manipulation of stimuli in the testing environment by the experimenter. Gender was also included as an independent variable. The dependent variable in the study was the novelty score for each individual's product as determined by three independent raters using a novelty rating scale adapted from reports of similar studies (Appendix A). The raters were specialists in different areas of education, specifically, master of science, registered-board certified art therapist; master of arts, elementary education/administration and education specialist in educational administration with 26 years classroom/administrative experience; and, bachelor of science, art education, with 17 years teaching experience.

Procedure

In order to gain access to this particular sample the experimenter contacted the principal of the Nebraska high school. After the study was reviewed and approved by the high school principal and the Emporia State University Internal Review Board for Treatment of Human Subjects (IRB), the experimenter's request to use high school students in the study was reviewed by classroom teachers who agreed to participate in the study. Authorization was then secured by the experimenter from the teachers and principal to sign up students at that particular Nebraska high school to participate in the proposed study.

The experimenter then sought collaboration of the high school teachers who agreed to participate in the study and asked for an amount of time during their classes. At this arranged time, the experimenter informed the students about the study and stated in general terms what participation would entail (i.e., 30 minutes, drawing task). After the explanation, informed consent documents (Appendix B) were handed out to all students enrolled and present in the classes. The informed consent documents were written in a way that addressed the legal guardian(s) of each child. The students were asked to return the forms within one week. At the end of the one week period, the experimenter collected the completed forms from the classroom teachers. Students whose parents had signed the informed consent document made up the sample in the proposed study. Each student who was given permission to participate was also required to read and sign an informed consent document (Appendix C) at the time of the experiment.

Once the number of participants per class was determined, the classes were randomly assigned to treatment groups by the experimenter. Each class was given a number and those numbers were written on slips of paper of equal size. The numbers were placed in a box, mixed, and then drawn one by one. Experimental conditions were assigned in the following order: no examples, ordinary examples, and creative examples; as class numbers were drawn, conditions were assigned in that order (e.g., first class drawn was assigned to no example group, the second to the ordinary example group, etc.).

The experimenter arranged a day with the teachers during which class time was used to conduct the experiment. On the arranged day, the experimenter went to the classroom before students arrived in order to prepare the room for testing. When participants arrived for class, they were instructed to sit quietly and not to disturb the testing materials under the desks. Placed underneath each desk was the following: 3 sheets of 8 1/2" x 11" white typing paper, and one box of colored pencils (all boxes of colored pencils used contained the same set of standard colors and were ready for use).

Each sheet of paper had a code penciled in by the experimenter on the back, right-hand corner to indicate which group the drawing was produced in. Groups shown creative examples were coded with an 'A', ordinary example groups 'B', and no example groups 'C'. The code was small and did not distract from the task.

Once the participants were seated, the experimenter gave each participant an informed consent document to sign (Appendix C). The experimenter read the consent document out loud while the participants read along silently. The experimenter then asked the participants if they had any questions. After several questions were addressed, the signed informed consent documents were gathered by the experimenter.

The experimenter then moved to the front of the room, asked for participant's attention, and described the task. The description of the task was the same for all groups:

> Imagine that you are a member of a deep sea expedition team and are exploring a part of the ocean that humans have never been to before. Your team has discovered a creature living underwater that is *very* different from anything seen before. Your task is to draw this creature and label or describe its parts next to the drawing. Please raise your hand when you have completed your drawing and it will be picked up. When your drawing has been collected, please stay seated until I indicate that time has run out.

For the example conditions, sample drawings were introduced after the description of the task:

> These examples are to help you think about creating your own original underwater creature. However, I do not want you to copy the examples. Please use this time to think about creating your own original creature. When I ask you to begin work, you will be given 20 minutes to complete your task. Be as imaginative and creative as you can.

For the no example condition the following was stated after the description of the task:

> Please use this time before I instruct you to begin working on the task to think about creating an original underwater creature. When I ask you to begin work, you will be given 20 minutes to complete your task. Be as *imaginative* and *creative* as you can.

Participants had 30 seconds (90 second total exposure time) to consider each of the examples or think about the task at hand, depending on the treatment condition. The procedure was adapted from that used by Marsh et al. (1999), Marsh et al. (1996), and Smith et al. (1993). In the experiments cited, the authors allowed participants 90 seconds of exposure to examples and 20 minutes to generate novel exemplars. This technique yielded valid results in each experiment.

Examples were projected onto a screen and were large enough to see clearly from every seat in the room. After the 90 second exposure the experimenter removed examples (when used) from view and instructed the participants to take the materials from under their desks and begin working on the task. If participants completed the task in less than 20 minutes, the product was collected by the experimenter and the participant was asked to produce another solution or sit quietly; only the original solution was scored. The experimenter collected all original products as they were completed and indicated the gender of the participant by marking a 1 on the front of the drawing if the individual was female and a number 2 on the drawing if the individual was male.

Three creative examples produced by high school art students before the experiment were shown to participants in the creative example condition. The creativity of these examples was confirmed using the novelty rating scale which was the dependent measure utilized in the experiment (see Appendix A). Further, three examples produced by high school art students before the experiment were shown to participants in the ordinary example condition. That the examples could not be considered creative was also verified by a novelty score.

At the end of 20 minutes the experimenter asked the group to stop working and collected the products from participants who used the entire amount of time. Next, the experimenter asked them not to discuss the experiment with anyone for the rest of the day, instructed them to place the colored pencils under their desk, and thanked them for participating. The experimenter then alerted the classroom teachers that the task had been completed and the teacher conducted class until the end of the period. After the period was over and students had left the room, the experimenter "reset" the room for the next group by placing the appropriate materials back under the desks. The same format was used for each group tested.

Instrumentation

The instrument that was used to rate the novelty integrated into each product was adopted from the coding techniques and criteria used in several similar studies and specifically described by Ward (1994). Ward and Sifonis (1997) have found that the coding scheme has been highly reliable across several experiments (p. 251). The novelty rating scale is designed in such a way that each product was scored either "typical" or "atypical" considering each of the following properties: bilateral symmetry, sense organs (eyes, gills, mouth), appendages (tail, legs, fins), and other (more than one creature depicted, more than four colors used in drawing, creature labeled as having thought, emotion, or speech, drawn in context atypical of animals living under water). Each feature indicated on the rating scale to be scored is listed with specific guidelines regarding what should be considered typical or atypical. For example, under the property "sense organs" (sight, sound, smell and touch) raters are instructed to give a score of atypical (one point) if the drawing depicts a novel use for standard sensory system (e.g., detecting odors by way of skin). The drawing is given a score of typical (no points) if there is not a novel use for standard sensory system shown in the drawing. In addition, a subjective score on global unusualness is required. Judges were asked to rate the creatures from 1 to 7, 1 being nearly identical to an already existing underwater creature and 7 being extremely different from an already existing underwater creature. When each of the attributes identified by the rating scale were scored, each feature coded atypical was given a numerical value of 1 and added to the global unusualness score. The resulting total was considered the overall novelty score for the drawing; scores could range from 1 to 36.

CHAPTER 3

RESULTS

A 2 X 3 ANOVA design was used. The two independent variables were type of example (creative example, ordinary example, and no example), and gender. The dependent variable was a novelty score as rated by three independent judges against a checklist. Each product had three novelty ratings (one from each judge), and these ratings were combined to produce the final score for that product. The dependent variable was obtained in the following manner.

When testing was complete, the experimenter shuffled and then numbered the drawings (1-102). Before the judges scored the drawings, the experimenter trained them so that they would be able to score consistently across the products. Training involved explanation and discussion of the procedures involved in the scoring of a product, followed by use of the instrument as practice. After this training, one rater was given all the products to score and when the rater finished rating all of the products, the individual notified the experimenter who retrieved the products and delivered them to the next rater. Judges were uninformed of the group identity of each example in order to allow for interrater reliability to be calculated using a correlation coefficient. Every drawing had three scores. The three scores were added together and that total was used as the final score for the product.

Post hoc techniques (i.e., Tukey procedure) were applied to the data as results of the two-way ANOVA indicated a statistically significant difference between conditions. Data was analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows program.

A analysis of variance (ANOVA) was performed with Type of Example (ordinary, creative, and none) and Gender used as independent variables, and Novelty Score used as the dependent variable. A significant main effect was found for Type of Example, F (2, 102) = 4.28, $p < .05$; observed power = .73. A post-hoc analysis (i.e., Tukey HSD procedure) was applied to the data due to the significant main effect indicated for Type of Example. Results of the analysis showed a statistically significant interaction between the creative example and ordinary example groups, $p < .05$.

Consistent with the first stated hypothesis, overall novelty scores for the creative example group (M = 32.38, SD = 12.18) were greater than those of the ordinary (M = 24.59, SD = 11.02) or no example (M = 29.87, SD = 11.51) groups. Thus, those participants who were exposed to creative examples before the task produced products that were judged to be more creative than participants who were shown ordinary examples or no examples at all.

Congruous with the second hypothesis, there was no statistically significant difference between creativity scores based on Gender, F (1, 102) = .53, $p > .05$. Overall, female participants performed no differently (M = 30.23, SD = 10.86) than males (M = 28.41, SD = 12.75) across groups.

The dependent variable used in the study was Novelty Score as obtained by three independent judges using a feature checklist. Each product was rated by all three judges (resulting in three separate scores), and these ratings were combined to produce the final score for that product. Inter-rater reliability was calculated using a correlation coefficient, the standardized item alpha = .90. Subsequently, it was determined that agreement between raters was adequately consistent across products. However, Rater 3 appeared to score products markedly higher (M = 11.93, SD = 5.44) than Rater 1 (M = 8.60, SD = 3.84) or Rater 2 (M = 8.59, SD = 3.72).

CHAPTER 4

DISCUSSION

A significant main effect for Type of Example supported the first stated hypothesis of the study. As a whole, individuals who were shown creative examples before a task produced more creative solutions than individuals who were shown ordinary examples or no examples at all. Further analysis indicated that specifically, products from the creative example condition were rated as significantly more creative than products from the ordinary example group. Overall, the ordinary example group produced the least creative drawings of the three conditions. The result seems to suggest that presenting examples before a task has the potential to affect creative performance in both a positive and negative way, depending on the specific interpretation of the statistic (e.g., creative examples seemed to facilitate creative performance in the study and ordinary examples seemed to constrain creative performance).

The mean score for the no example group (M = 29.87) was only slightly lower than the mean score for products in the creative example condition (M = 32.38). The statistic implies that not showing examples before a task does not negatively affect creative performance to a significant degree. Further, there was no significant difference indicated for creativity scores based on gender. These results were consistent with the second hypothesis described for the study and adds to a broad base of literature which confirms there is no creative advantage, in terms of performance, due strictly to gender.

It is recognized that prior knowledge is a variable that impacted idea generation for the task. It is understood that individuals who participated in the study possessed a variable amount of prior knowledge and personal experience regarding "under water creatures". However, it is not unreasonable to assume a basic level of information to be present across most high school students. It has been demonstrated that prior knowledge influences the development of new ideas ("structured imagination") and also affects how examples are processed (Ward, 1994, 1995). There seemed to be evidence of "structured imagination" utilized by participants in that the most basic "under water creature" concepts were manifested in a majority, if not all, of the drawings produced for this study. It was evident that some features were so strongly associated with the category, they persisted despite the experimenters instructions to "be creative" and to draw a creature that had "never been seen before." Fins, scales, tentacles, and other features commonly associated with life existing under water appeared abundantly across all conditions. Yet, these ideas were not rated as "creative" unless they were expanded on or a novel use was assigned to what would otherwise be considered a "common" feature.

Those shown creative examples were most often able to "think beyond" typical functions and placement of common features. This affirms the conclusion of Ward & Sifonis (1997) which is, using existing concepts allows for more convenient development of new and original ideas. For example, while products of the creative example condition did demonstrate common features, as a whole, they also showed the most innovative and mature evolution beyond the original concept. Being able to move away from typical solutions, while still retaining important, recognizable concepts, resulted in a higher novelty score based on criteria which made up the rating scale.

The higher mean score achieved by the creative example group supports results of a study conducted by Marsh et al. (1996), which established that examples can facilitate more elaborate designs and subsequently, enhance creativity. It is also possible the creative examples presented before the task may have served as "feedback" regarding the degree of novelty expected from participants. The more creative environmental context of that condition may have assisted with idea formation and resulted in a perceived higher standard for creative output.

In past experiments that investigated the access and use of examples in problem solving, results consistently indicated that individuals use details of earlier examples when addressing current tasks (Bredart et al., 1998; Ross, 1987; Ward & Sifonis, 1997). The results of the present study may have been influenced by this phenomenon in that participants shown creative examples could have used and/or adapted features from the presented examples (although they were instructed not to copy). It is possible participants received credit for including the ideas although they were not entirely original. It should be noted that no product in this study was so similar to a presented example that it was considered to be a "copy". However, future research should address this concern by evaluating the inclusion of example features in drawings produced participants in each group (e.g., winged creature shown as an example, indicate number of participants who include wings). Such a tally, along with the overall novelty ratings, would demonstrate more clearly the effect of examples on novelty.

Results of this study would also support the Smith et al. (1993) hypothesis that conformity, induced by introducing examples, can constrain the generation of creative ideas. In all three experiments described by Smith et al. (1993), subjects' creative ideas tended to conform to the examples shown prior to the creative generation task. A "conformity effect," (Marsh et al., 1999) may account for the lower scores overall for products produced in the ordinary example condition. It is likely creative thinking was constrained in this condition for the same reasons it was facilitated in the creative examples group. Ordinary examples likely set a precedent and subsequently, a lower standard for creativity in that condition. The examples, due to the fact they were chosen for their lack of significant novelty, did not provide participants with creative details and ideas with which to work and elaborate upon. Fixation on and conformity to typical properties present in the ordinary examples shown most likely served to constrain creative performance in that group.

The above conclusion is supported by additional results from the present study. Drawings of participants in the no example condition ($\underline{M}$ = 29.87) were, as a whole, rated as more creative than drawings designed by participants in the ordinary example group

($\underline{M}$ = 24.59). Although the statistic is not mathematically significant, it seems to suggest that when the most creative product is desired, not showing any examples is preferable to showing examples that have the potential to block effective novelty by means of fixation on "non-creative" solutions. This idea is affirmed by results of research conducted by Ward (1994) which demonstrated that when a person relies primarily on examples they become fixated on its properties.

The rating scale used in this study was focused, basic, somewhat subjective, and able to measure only a facet of the concept of creativity (i.e., novelty). Due to these limitations (which were necessary to render the concept of creativity measurable for the purpose of experimental research), some creatures may have ranked lower than an equally "creative" creature due to rather narrow definitions of features which were allowed points for novelty. The overall novelty scores were likely influenced by the scope of the scale and also the raters personal knowledge of underwater sea creatures (e.g., global unusualness item). Another important factor which likely influenced the results of the experiment is participants' intelligence. It was beyond the scope of the present study to consider this factor, but it's significance in terms of creative performance should be analyzed in future research. Future research that studies how examples and other environmental variables enhance or constrain creativity is important due to practical implications the results would have regarding real world functioning across a variety of environments.

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Appendix A

Rating Scale for Novelty

Identification Number:

Major Scoring Categories

SCORED PROPERTIES	Typical	Atypical Variatio n
BILATERAL SYMMETRY		
1. If a vertical line was drawn down the middle of the creature each side would mirror the other (minor differences considered typical)		
SENSE ORGANS (sight, sound, smell, and touch)		
1. Any exaggerated or unusual sensory ability (e.g., infrared detectors, gravity sensors) code atypical		
2. Novel use for standard sensory system (e.g., detecting odors by way of skin) code atypical		
3. Other feature that is not characteristic of most typical see creatures (e.g., eyes on the end of stalks) code atypical		
Eyes		
1. Creature is depicted as having 2 eyes (if there is any variation in number code atypical)		
2. Eyes are depicted in a typical arrangement code typical (e.g., on head and above mouth - if there is variation in the arrangement code atypical)		
3. Eyes are labeled as providing sight code typical (if not labeled code typical; if identified as having unusual use, code atypical)		
Gills		
1. Creature is depicted as having 1 *pair* of gills code typical (if there is any variation in number code atypical)		
2. Gills are depicted in a typical arrangement code typical (e.g., on the side of the body - if there is any variation in the arrangement code atypical)		
3. Gills are labeled as providing air or as means of breathing code typical (if not labeled code typical; if identified as having unusual use, code atypical)		
Mouth		
1. Creature is depicted as having 1 mouth code typical (if there is any variation in number code atypical)		
2. Mouth is depicted in a typical arrangement code typical		

(e.g., located on the lower portion of head - if there is any variation in the arrangement code atypical)		
3. Mouth is labeled as means of eating, tasting, etc. (if not labeled code typical; if identified as having unusual use, code atypical)		
APPENDAGES (defined as any extension from main body)		
1. Any exaggerated or unusual appendage code atypical (e.g., wheels instead of legs, suction cup feet, etc.)		
2. Novel use for appendages code atypical (e.g., tail capable of generating electrical charges to stun prey, hair with claws for protection)		
3. Other appendage that is not characteristic of most typical sea creatures code atypical (e.g., human-like hands)		
Tail		
1. Creature is depicted as having 1 tail code typical (if there is any variation in number code atypical)		
2. Tail is depicted in a typical arrangement code typical (e.g., extending from the back of the body - if there is any variation in the arrangement code atypical)		
3. Tail is labeled as propelling or defending creature code typical (if not labeled code typical; if identified as having unusual use, code atypical)		
Legs		
1. Creature is depicted as having 0, 2 or 4 legs code typical (if there is any variation in number, code atypical)		
2. Legs are depicted in a typical arrangement code typical (e.g., as support for the body and extending to the ground - if there is any variation in the arrangement code atypical)		
3. Legs are labels as means of motion (walking, running, etc.) and/or support code typical (if not labeled code typical; if identified as having unusual use, code atypical)		
Fins		
1. Creature is depicted as having 1 or 2 fins code typical (if there is any variation in number, code atypical)		
2. Fins are depicted in a typical arrangement code typical (e.g., on tail or on back similar to a dolphin or shark - if there is any variation in the arrangement code atypical)		
3. Fins are labeled as means of propelling and/or balance code typical (if not labeled code typical; if identified as having unusual use, code atypical)		
OTHER		

1. More than 1 creature depicted (code atypical)		
2. More than 4 colors used in drawing (code atypical)		
3. Creature labeled as having though, emotion, or speech (code atypical)		
4. Drawn or labeled in a context atypical of animals living underwater (i.e., watching TV or in a house)		
GLOBAL UNUSUALNESS		
1. Rate from **1** = nearly identical to an already existing underwater creature to **7** = extremely different from already existing underwater creature		

TOTAL NOVELTY SCORE:

Appendix B

Participation Consent Form (Legal Guardian)

Please read this consent form. If you have any questions, contact the experimenter and she will answer the question.

Your child is invited to participate in a study investigating how showing examples as opposed to not showing examples may influence performance on a drawing task. Your child will have an equal chance of being assigned to a group that is shown examples and a group that is not. Examples shown will be pictures of never before seen underwater creatures that have been created by the high school art class for use in the study. Your child will be asked to draw the most "creative" underwater creature that he/she can. The study will take approximately 30 minutes and has been approved by the appropriate school officials and school board members.

Information obtained in this study will be identified only by code number. Your child's participation in this study is completely voluntary. Should your child wish to terminate participation, he/she is welcome to do so at any point in the study. There is no risk or discomfort involved in completing the study.

If you or your child has any questions or comments about this study, please feel free to ask the experimenter. If you have any additional questions you would like to have addressed before your child participates, please contact Jessica Wilson, 402-443-3070.

Your permission is appreciated.

I, __________________________, have read the above information and have decided to
(please print name)
allow my child to participate. I understand that my child's participation is voluntary and that he/she may withdraw at any time without prejudice after signing this form.

______________________ ______________________ __________
(signature of parent) (name of child) (date)

THIS PROJECT HAS BEEN REVIEWED BY THE EMPORIA STATE UNIVERSITY INSTITUTION REVIEW BOARD FOR TREATMENT OF HUMAN SUBJECTS FOR THE PROTECTION OF HUMAN SUBJECTS.

Appendix C

Participation Consent Form (Student)

Please read this consent form. If you have any questions about the form or what is expected of you during the study, ask the experimenter and she will answer your question.

You will be participating in a study that is looking at the difference showing people examples or not showing people examples has on a drawing task. You may be shown some examples or you may not be shown any examples, but everyone will be asked to draw a creative picture. The study will take 30 minutes from start to finish and has been approved by the principal, superintendent and school board.

Taking part in this study is up to you. If you do not want to complete the study, you will not get in trouble, you will be allowed to participate in a study hall monitored by your teacher. There is nothing about the study that will make you feel uncomfortable.

If you have any questions about the study, please ask the experimenter now.

Thank you for taking part in this study.

I, __________________________, have read the above information and have decided to
(please print name)
take part in the study. I understand that I do not have to take part if I do not want to and that even though I have signed this form I can quit any time and not get in trouble.

____
(sign your name here)

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Investigation of the Effect of Creative Examples on Performance

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Signature of Graduate Office Staff Member

August 13, 2001

Date Received