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by

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Enhancing Creativity through Exercise in Organizational Settings:

The Effects of Exercise on Creativity and the Role of Mood as a Mediator
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Abstract

Previous research has revealed an undeniable relationship between exercise and mood; that is, exercise has been shown numerous times to enhance mood (e.g., Berger & Owen, 1988). Moreover, research in the field of creativity has revealed a connection between mood and creativity (e.g., Isen & Daubman, 1984), including a causal effect of enhanced mood on greater displays of creativity (Richards, 1994; Shapiro & Weisbert, 1990). As creativity is an important employee quality in an ever-changing corporate world, the purpose of the present research was to expand on these two well-established relationships between exercise and mood and mood and creativity to explore the direct relation between exercise and creativity. The establishment of direct relationships between exercise and the enhancement of qualities such as creativity that are highly valued in organizations may make an important case for the immediate benefits of exercise and of the implementation of corporate wellness programs. Results of the present study failed to reveal a relationship between recency of exercise and level of creativity. However, a positive correlation between frequency of exercise (hours per week) and positive affectivity was revealed. Given the robust field of research displaying the positive effects of exercise and the small sample of research linking exercise to enhanced creativity, future research on this possible link is warranted.
Chapter I

Review of the Literature

With obesity on the rise in the United States and a multitude of health problems associated with being overweight, membership in health clubs and fitness centers has become a popular way for people to combat weight gain and maintain healthier lifestyles. Even throughout the economically trying times posed by the last decade, the health and wellness industry has continued to grow. As of 2009, 53.1 million members used 38,000 fitness facilities in North America (International Health, Racquet, and Sportsclub Association) as a means of becoming or remaining healthy. Organizations have also considered the benefits of exercising and living a healthy lifestyle. In recent years, many organizations have begun to implement wellness initiatives to encourage healthy habits among workers and ultimately among the organization as a whole (Aldana, 2001). It is likely that many of the potential benefits of wellness initiatives are yet to be uncovered or fully understood. Enhanced creativity among employees may be a direct, yet unanticipated, result of wellness initiatives.

Creativity is a construct that continues to gain attention in research and become more important in industry. Beginning with Guilford’s (1950) call for more research on creativity in psychology in the 1950 edition of The American Psychologist, over the past 60 years, creativity research has continually gained momentum and interest (Hennessy & Amabile, 2010). In any economic system driven by competition, organizations that find more creative and innovative ways to create and market products and services are more likely to succeed, and in today’s
globalized economy, this is especially important. Although enhancing creativity is not a primary reason why organizations choose to promote wellness, it may be an inevitable and welcomed secondary outcome experienced as a byproduct of one or more primary outcomes, specifically the ability of exercise to improve morale or mood (Milligan, 2000). In the following sections, organizational wellness initiatives will be discussed, including their intended purpose and uncovered benefits. Next, research on exercise and mood will be reviewed. This will be followed by a review of the construct of creativity and the effects that mood has been found to have on creativity. Finally, there will be a discussion and review of the brief literature that has explored and supported a direct link between exercise and creativity. The purpose of the present study is to expand on this body of literature by establishing a link between exercise and creativity, with mood as a mediating variable.

Organizational Wellness Initiatives

Organizational wellness initiatives are programs sponsored by organizations, either on or off-site, that have a goal of promoting health and wellness and identifying and correcting health-related problems (Wolfe, Parker, & Napier, 1994). The objective of organizational wellness initiatives is to combat the loss of $300 billion that organizations reportedly lose each year as a result of absenteeism, workplace stress, turnover, and health care costs (Stambor, 2006). In recent years, it has been estimated that approximately 90% of large businesses offer some sort of wellness initiatives to employees (Milligan, 2000). In general, organizational wellness programs fall under two categories—those that involve only a fitness program, such as a gym membership or an on-site gym, and those that offer educational or health screening opportunities in addition to the fitness component, also known as wellness initiatives (Parks & Steelman, 2008). Aside from fitness, the majority of wellness programs can be classified as risk assessment, health
education, or demand management (Conrad, 1988). For example, some organizations may offer blood pressure screenings, body fat measurements, and cholesterol screenings (Divine, 2005). The most commonly cited reasons to implement wellness initiatives have been to keep workers healthy, reduce healthcare costs, retain employees, improve morale, recruit new employees and improve productivity (Milligan, 2000).

Unhealthy employees cost organizations billions of dollars each year. Obesity in the United States has more than doubled since 1980 (Pronk, 2008), and this creates many other issues for employers, all of which in the end affect organizations’ profitability. Obese workers are more costly than workers who maintain a healthy weight (Pronk, 2008). There is a positive correlation between body mass index and number of sick days, medical claims, and health care costs (Burton, Chen, Schultz, & Edington, 1998). Additionally, coworker interactions are negatively impacted by excessive weight, whereas increased physical activity and cardiorespiratory fitness have been linked to improvements in quality and quantity of work performed and overall job performance (Pronk, Martinson, Kessler, Beck, Simon, & Wang, 2004). Obesity has also been found to be associated with costs related to short-term disability (Burton et al., 1998) and workers’ compensation (Ostbye, Dement, & Krause, 2007). As exercise and healthy lifestyle changes may help to decrease the prevalence of obesity, the implementation of programs that promote exercise and healthy choices may also decrease many of the obesity-related problems and costs that organizations face.

A review of the literature on wellness initiatives found health promotion programs to be associated with lower levels of absenteeism and health care costs and fitness programs to be associated with reduced health care costs (Aldana, 2001). A separate review of the literature revealed that participation in an organizational wellness initiative was associated with increased
job satisfaction and decreased absenteeism (Parks & Steelman, 2008). The general consensus has been that these programs are effective in meeting their long term goals. However, there have been mixed findings regarding the length of time between program implementation and observable change, specifically in terms of healthcare dollars saved (Aldana, 2001). Aldana (2001) found that following a one- to two-year period, some programs significantly reduced healthcare costs, and some did not. After a three-year period, however, almost all programs significantly reduced healthcare costs among participating employees. In a profit-driven economy, organizations may be reluctant to implement programs that often take several years to positively influence health care costs. More research on and awareness of some of the immediate effects of exercise and other healthy lifestyle choices may be encouraging for employers that are wary of implementing a program that may not promise an immediate return on investment. The short-term, day-to-day effects of organizational wellness initiatives, however, have been mostly neglected in research.

Some organizations allow employees to use on-site gyms during the work day. Dick’s Sporting Goods (corporate offices), for example, has a gym on-site and allows employees to take a break from normal work-related tasks to exercise. Google’s main campus in Mountain View, California has four gyms, all of which are free to Google employees. As more organizations follow the lead of organizations such as Dick’s Sporting Goods and Google, they may find that employees who take advantage of on-site gyms may experience cognitive benefits associated with exercise. In turn, with consistent employee participation, the individual benefits of exercise may become organizational benefits of a better, healthier workforce that is more productive in many ways.
Although the idea of an employee taking a break from work to exercise is well in line with the overarching goals of wellness initiatives—to improve employees' health and wellness—it is different from traditional wellness programs. The effects of physiological changes that happen immediately after exercise may be different from the overall effects of a healthy lifestyle. Consistent exercise is important for one's health, but if a person exercises, and is then back “in the office” only a few minutes later, he/she may experience more than just enhanced overall health and wellness. A person's mood immediately following exercise is often positively altered (Berger & Motl, 2000), and a positive mood has been associated with a host of desirable outcomes, such as increased job satisfaction (Kohan & O'Connor, 2002) and an increased prevalence of prosocial behavior (Carlson, Charlin, & Miller, 1988).

Exercise and Mood

Mood has been conceptualized as a general affective state that persists for a longer period of time than an emotion, typically lacks an identifiable cause, and is not directed toward anyone or anything specific (Morris, 1989; Thayer, 1989). Some have conceptualized mood in terms of six factors—tension/anxiety, depression/dejection, anger/hostility, vigor/activity, fatigue/inertia and confusion/bewilderment (McNair, Lorr, & Droppelman, 1971). The Positive and Negative Affect Schedule - Expanded Form (Watson & Clark, 1994) has been shown to measure 5 out of 6 of these constructs. Using this scale of measurement, they are referred to as fear (tension/anxiety), sadness (depression/dejection), hostility (anger/hostility), general positive affect (vigor/activity), and fatigue (fatigue/inertia). Mood is the result of a person's rating for each factor.

Exercise has been shown to enhance mood in a number of different studies, utilizing many different forms of exercise. Sessions of varying length and intensity of aerobic dance
(Dyer & Crouch, 1988), cycling (Farrell et al., 1986), Hatha yoga (Berger & Owen, 1988),
jogging (Berger & Owen, 1988), rock climbing (Motl, Berger, & Leuschen, 2000), swimming
(Berger, Grove, Prapavessis, & Butki 1997), Tai chi (Jin, 1992), and weight-training (Dyer &
Crouch, 1988) have all been associated with enhanced moods immediately following exercise.
Furthermore, the effects of exercise on mood have been studied in both clinical and non-clinical
populations. Findings have been most robust in non-clinical populations, and one study found
exercise to be the best of 10 techniques (e.g. watching TV, eating food and consuming alcohol)
to enhance mood in a non-clinical population, based on a self-report questionnaire (Thayer,
Neuman, & McClain, 1994).

Many studies examining the relationship between mood and exercise have utilized the
Profile of Mood States (POMS; McNair et al. 1971) to measure mood following exercise, and in
conducting a meta-analysis on mood research in sport and exercise psychology, LeUnes and
Burger (2000) found that the POMS seems to be the most popular instrument for measuring
mood in sport and exercise settings. As a quick self-report measure high on internal consistency,
the POMS has been widely used in research exploring the relationship between exercise and
mood. The POMS consists of six separate scales that measure the six factors articulated by
McNair et al. (1971). Bourgeois, LeUnes, and Meyers (2010) found alpha values for internal
consistency to range between .79 (confusion) and .93 (depression) for the six scales. Overall,
research with the POMS has indicated a significant positive relationship between exercise and
enhanced mood.

Although the PANAS-X has not been used as widely as the POMS, it has been used in
sports and exercise settings to some extent (LePage & Crowther, 2010), and findings utilizing the
PANAS-X have been consistent with findings utilizing the POMS (Watson & Clark, 1994). The
ENHANCING CREATIVITY THROUGH EXERCISE

PANAS-X measures mood from a high level perspective in terms of positive and negative affectivity, and more specifically, in terms of 11 specific affects that make up the constructs of positive and negative affectivity. Five of these specific affects have been validated against their POMS counterparts, and the two scales were found to generally measure the same constructs (Watson & Clark, 1994).

Dyer and Crouch (1988), in a longitudinal study utilizing a student sample, found that running, weight training, and aerobic dance were all positively associated with an enhanced mood over time. Participants reported their mood several times a day over the course of a semester. Compared to a non-exercising control group, participants in all three conditions experienced more positive moods following exercise. Additionally, from the beginning to the middle of the semester, participants in the running group reported a decrease in tension, anger and depression, whereas participants in the control group reported an increase in these factors. Although this study utilized a student sample over the course of a semester, if the drop in tension, anger, and depression was attributable to the increase in frequency and consistency of exercise, then an organization that implements a wellness program with a fitness component may very well see a drop in these factors among participating employees shortly after implementation.

Jin (1992), using both the POMS and physiological measurements, found that Tai Chi and brisk walking caused a drop in mood disturbance levels that had been manipulated using stressors in an adult population. Compared to participants in a neutral reading group, after participating in Tai Chi, participants experienced a greater reduction in state anxiety and a greater increase in vigor, as measured by the POMS. Participants in the Tai Chi and brisk
walking groups reported an improvement in mood state, and this finding was further backed by physiological evidence of a drop in salivary cortisol levels, which indicate stress.

Overall, the empirical support for the ability of various forms of exercise to enhance mood and reduce stressors is robust and well established. In the business world, which is riddled with stressful situations, the implementation of a wellness program that allows employees to exercise before or during working hours may aid in cultivating a workforce that is not only physically healthier but is also less stressed and in a better overall mood. As the next two sections will discuss, creativity has become important for organizations to stay ahead of competition, and exercise-induced enhanced mood may lead to higher levels of creativity.

Creativity

Although one agreed-upon definition of creativity does not seem to exist (Mumford, 2003), researchers agree that creativity involves the generation of ideas, insights, or problem solutions that are both novel and potentially useful (Amabile, 1983). Creativity has typically been conceptualized in two ways—“Big C” represents eminent creativity and “Little c” represents everyday creativity. “Big C” refers to rare displays of creativity that are acknowledged by knowledgeable others and have an impact on others (Hennessey & Amabile, 2010). Examples of those who may be considered “Big C” creative include Einstein, Picasso, or Mozart—those whose creative contributions made a lasting impact in both their respective fields and the world in general. “Little c” creativity, on the other hand, is more common. It refers to daily problem solving and the ability to adapt to change and it is generally acknowledged by an individual or a few others (Hennessey & Amabile, 2010). The majority of psychological research has focused on “Little c,” and for the purpose of organizational research, the focus has remained on “Little c,” because this is the type of creativity that organizations need to understand in order to apply
the construct to their procedures. Because creativity is so broadly defined, it is also broadly applicable. In an organizational setting, "creative" may be a term used to describe a process that cuts costs, creates artwork on a label, or designs a selection system that succeeds in finding the best employees; almost anything can be done creatively. Although people like Mozart and Einstein may have possessed levels of creativity that are unattainable for most people, for the general population, including workers in organizations, the ability to think creatively on a day-to-day basis may be affected by many different factors, including mood.

Mood and Creativity

Research has largely supported a link between mood and creativity. Seminal work by Isen and colleagues (Isen & Daubman, 1984; Isen, Daubman, & Nowicki, 1987; Isen, Johnson, Mertz, & Robinson, 1985) in the 1980’s revealed the relationship between mood and creativity. In an early study, Isen and colleagues (1987) manipulated mood through watching a film. Those in the positive mood condition viewed a 5-minute segment of a comedy film, Gag Reel, and those in the neutral mood condition viewed a 5-minute segment from a math film, Area Under a Curve. Participants were then given a manipulation check in which they rated the pleasantness of unfamiliar words. The manipulation was successful—participants in the positive mood condition rated the unfamiliar words more positively than participants in the neutral mood condition, $t(25)=2.00, p < .05$. Finally, participants completed a creativity task, originally used by Duncker (1945), in which they were provided with a box of matches, a box of tacks, and a candle. On the wall in the room was a corkboard. Participants were instructed to affix the candle to the corkboard so that it did not drip wax on the floor when lit. They were given 10 minutes to complete the task. They found that participants in the positive mood condition produced more
solutions to the task than did participants in the neutral mood condition, \( \chi^2(1, N = 27) = 8.19, p < .01 \).

The effect of mood on creativity has been further explored and further supported many times since then (Isen & Baron, 1991; Mumford, 2003). Essentially, those in a positive mood are more likely to display creativity than those in a neutral mood (Shapiro & Weisberg, 1999; Richards, 1994). A meta-analysis by Baas, de Dreu, and Nijstad (2008) synthesized mood-creativity research. Creativity measures were coded into eureka/insight tasks, flexibility, fluency, originality, and composite measures. Studies that utilized one or more of these measures in the assessment of creativity were included in the meta-analysis. Findings supported the hypothesis that positive moods produce more creativity than mood-neutral controls.

Within the context of mood-creativity research, mood has been measured on three separate components—hedonic tone, level of activation, and association with regulatory focus (Baas et al., 2008). Hedonic tone refers to whether a mood is associated with positive or negative feelings (Murray, Sujan, Hirt, & Sujan, 1990), whereas level of activation refers to whether a mood is arousing versus relaxing or depressing. Research on level of activation has revealed a curvilinear relationship in which capacity for complex thinking increases with arousal, but then decreases as the level of arousal becomes too high (Berlyne, 1967). Finally, regulatory focus refers to a promotion focus versus a prevention focus. A promotion focus is characterized by motivation to attain nurturance, and a prevention focus is characterized by motivation to attain security (Higgins, 1997). Stated differently, a promotion focus is more proactive and approach-oriented, and a prevention focus is more reactive and avoidance-oriented. Different moods are characterized by where they fall on the continuum for each of these separate scales. For example, a happy mood is positive, activating and promotion-focused, and a relaxed mood is also positive,
but it is deactivating and prevention-focused. Bass et al. (2008) found happiness to have a positive impact on creativity.

For organizations, especially those that value creativity, these findings are important. If organizations can find ways to enhance the moods of employees while they are at work, they may in turn succeed in developing more creative employees, and in today's competitive global economy, slightly more creative employees may be just what organizations need to create better, more competitive products and services. The following section will review exercise as one possible way that organizations may go about enhancing employees' moods and the effects that at least one researcher has found exercise to have on creativity.

Exercise, Mood, and Creativity

Research measuring a direct link between exercise and creativity is sparse. Gondola (1986, 1987) first considered the relationship based on the established link between exercise and other aspects of cognition, such as problem solving (Gutin, 1966), spatial tasks (Ismail & El-Naggar, 1980), and simultaneous and successive processing (Ismail & El-Naggar, 1981). In order to explore a possible link between exercise and creativity, Gondola (1986) conducted several studies using students in physical education classes. She tested the impact of consistent exercise on creativity, as measured by the Alternative Uses Task (Guilford, 1967) with scores on alternative uses, remote consequences, and obvious consequences.

Guilford's (1967) Alternative Uses Task is a task in which participants are given a series of common objects and asked to think of as many uses apart from the intended use as they possibly can in a specified period of time. Responses are often scored based on four separate dimensions--originality, fluency, flexibility, and elaboration. For the purposes of her series of studies, Gondola (1986, 1987) defined alternate uses as flexibility of thinking, obvious
consequences as expressions of different ideas, and remote consequences as originality and uncommon responses. Although the use of the Alternative Uses Task has varied over time and across studies, the general idea has been to assess divergent thinking ability, or the ability to think of many uses for a single item, where responses are often novel and lead to a broad perspective (Guilford, 1967).

It was found that compared to scores on a pre-test assessing alternative uses, obvious consequences, and remote consequences taken at the beginning of a semester, after students had been consistently running for 20 minutes twice a week for a semester, scores on a post-test were significantly higher (Gondola, 1986). She also compared pre-test scores with scores from a post-test taken immediately following a 20-minute run, and found that scores on the post-test were significantly higher. In another study, Gondola (1987) successfully replicated her findings using aerobic dance, rather than jogging, as the stimulus.

Blanchette, Ramocki, O’del, and Casey (2005) replicated Gondola’s (1986, 1987) findings that exercise can positively influence creativity, and they extended the area of research to consider the immediate and residual effects of exercise. They found no difference in creative potential, as measured by Figural Tests A and B of the Torrance Tests of Creative Thinking (TTCT), between participants who were tested immediately following 30 minutes of moderate aerobic exercise and participants who were tested 2 hours after the completion of exercise. The Torrance Tests of Creative Thinking is a series of tests used to measure creative potential. The TTCT-Figural is a series of tests that includes three components: picture construction, picture completion, and repeated figures of lines or circles. Each of the activities requires the participant to complete or create a drawing. Participants’ drawings are scored based on five dimensions: fluency, originality, elaboration, abstractness of titles, and resistance to premature closures (Kim,
2006). Both groups demonstrated significantly more creative potential than participants in the group that participated in no exercise. These findings both support the theory that exercise enhances creativity and suggest that cognitive functioning, specifically in terms of creativity, is positively affected for at least 2 hours following exercise.

With support for links between exercise and positive mood, positive mood and creativity, and exercise and creativity, it seems that positive mood may be the variable mediating the relationship between exercise and creativity. Although enhancing mood during the work day has not been considered one of the primary purposes for wellness initiatives, it may be a positive benefit enjoyed by organizations that allow employees to take time during the work day to exercise. In turn, enhanced mood may play a role in a greater capacity for creativity, resulting in more novel products and services and greater profitability. The purpose of the present study is to explore the link between exercise and creativity and the role of mood as a mediating variable.
Chapter II
Rationale and Hypotheses

As organizations implement wellness initiatives and encourage employees to exercise and maintain overall healthier lifestyles, they may be pleasantly surprised by the other organizational benefits that come along with healthier employees and lower healthcare costs. Research has strongly supported the proposition that exercise enhances mood (Berger et al., 1997; Berger & Owen, 1988; Dyer & Crouch, 1988; Farrell et al., 1986; Jin, 1992; Motl et al., 2000). Further, research by Blanchette et al. (2005) suggests that exercise’s effects on cognitive functioning may last at least 2 hours following a bout of exercise. As organizations strive to maintain a diverse workforce of different people with different interests, research findings that a number of different types of exercise, from cycling to yoga and aerobic to anaerobic, positively affect mood may be especially encouraging. Considering past research, the following is hypothesized:

Hypothesis 1: There will be a negative relationship between length of time since participants last exercised and score on the PANAS-X measure of mood.

Along with the direct effect that exercise has been demonstrated to have on mood, mood has been demonstrated to have a direct effect on creative performance (Isen & Daubman, 1984; Isen et al., 1987; Isen et al., 1985). With strong direct relationships between exercise and mood, and mood and creativity, and some support in the literature for a link between exercise and creativity (Gondola, 1986, 1987; Blanchette et al., 2005), it can be expected that a relationship between exercise and creativity may exist and may be detected, attributable to mood as a mediating variable.
Hypothesis 2: Mood will mediate the relationship between exercise recency and creativity.

Considering that creativity on a task may be manipulated through the manipulation of mood, overall creative capacity may be enhanced through consistent exercise. Those who exercise regularly may perform better on a creativity task than those who do not exercise regularly. Gondola (1986) found support for this idea, and for the purposes of the present study, this should be considered. It is possible that an overall history of exercise may be more predictive of creativity than the benefits provided by recent exercise. Because overall exercise history and recency of exercise are distinct variables that may be influenced by organizations in different ways, assessing their relative effects on creativity seems warranted.

Hypothesis 3: The extent to which an individual exercises regularly will be predictive of creativity above and beyond the effects of exercise recency.
Chapter III

Method

Participants

Participants for this study were university students enrolled in a psychology course who participated either for course credit or extra credit. They were recruited through the Xavier University Psychology Department’s participant pool. Originally, 115 students participated. Twelve participants either failed to indicate how many hours had passed since they last exercised or indicated that they had not exercised recently. Because of wide range of time that had passed since many participants had last exercised, those who had clearly done so within 1 week were included in analysis. Four participants gave responses (e.g., “Last Tuesday”) that could not be quantified based on available information. One participant failed to properly complete the PANAS-X. Finally, one participant’s responses on the Alternative Uses Task were not alternative uses for the items; rather, the participant treated the task as a word association exercise. Eliminating these 18 participants left data from 97 participants for analysis.

Participants ranged in age from 18 to 24 years with a mean age of $M = 20.36$ years ($SD = 1.31$ years), and of the 97 participants, 47 identified as male and 50 identified as female. The breakdown of participants in terms of age, race, and gender is displayed in Table 1.
Table 1

Demographic Breakdown of Participants

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<tr>
<th>Gender</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Female</td>
<td>47</td>
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</tr>
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</table>
Measures and Materials

Positive and Negative Affect Schedule - Expanded Form. Mood was assessed using the Positive and Negative Affect Schedule - Expanded Form, commonly referred to as the PANAS-X (Watson & Clark, 1994). The PANAS-X was developed as an expansion of the PANAS. The original form only measured positive affectivity and negative affectivity, whereas the PANAS-X still measures positive affectivity and negative affectivity, but can be broken down into 11 specific affects for further analysis. The PANAS-X consists of 60 items, half of which measure positive affectivity and half of which measure negative affectivity. Participants are asked to rate the extent to which they are feeling 60 different feelings and emotions on a Likert-type scale ranging from very slightly or not at all to extremely. A score is given for each positive affectivity and negative affectivity. Both the positive affectivity and negative affectivity scales were found to be internally consistent with alphas of .89 and .87, respectively. For the purposes of the present research, both scales were administered, but only positive affectivity scores were used for analysis. Copyrighted measures are not included in this document, but source information for the PANAS-X can be found in Appendix A.

Alternative Uses Task. The Alternative Uses Task (Guilford, 1967) was used to assess participants' creativity. Developed in 1967, this task and tasks like it have been widely used in creativity research (Chamorro-Premuzic, 2006). It is a creativity task that specifically measures divergent thinking ability, which is the ability to think of many uses for a single item, where responses are often novel and lead to a broad perspective (Guilford, 1967). It provides participants with several common objects, and participants are asked to generate as many uses for the object as possible in a short period of time. For example, although a paper clip is most commonly used to hold papers together, it may also be used as a key to pick a lock. The uses
generated are assessed based on four dimensions—originality, fluency, flexibility and elaboration.

Scoring was consistent with prior research (Gilhooly et al., 2007). Specifically, originality was based on the comparison across responses by all participants. Responses generated by only 5% of participants were worth 1 point, and responses generated by only 1% of participants were worth 2 points. Responses given by more than 5% of participants did not receive points based on originality. Fluency referred to the total number of uses that a participant thought of for an item. If a participant thought of eight uses for an item, then he/she was awarded eight points. Flexibility referred to the different categories under which the uses fall. For example, considering a paper clip, if a participant said it could be used as an earring or on a necklace, both of these uses fell under the same category of “jewelry.” The participant was awarded points equal to the number of different categories. Finally, elaboration referred to how much detail was included in a response. Continuing with the example of a paper clip, a response of “pick the lock on your car door after you lock your keys inside” was worth more points than a response of “pick a lock.” Responses could be awarded 0-2 points. The accumulation of more points on the Alternative Uses Task represents greater creativity.

Because the dimensions of flexibility and elaboration must be scored by a rater and include some degree of subjectivity, two different raters who were familiar with the task and these particular dimensions rated each. Interrater reliability was assessed as the correlation between ratings made by the two raters, consistent with prior research. Using the Alternative Uses Task and two raters, Gilhooly, Fioratou, Anthony, and Wynn (2007) found an interrater reliability of $r = .85$ at a significance level of $p < .01$. Using a similar task and two raters, Kaufmann and Vosburg (2002) found an interrater reliability of $r = .77$. 
In the present study, two raters scored creativity responses for the categories of fluency and elaboration. After initially scoring each response in the category of fluency, interrater reliability was $r = .91$. However, after initially scoring all items, interrater reliability for elaboration was only $r = .62$. Because this was below the $r = .70$ threshold, the two raters discussed discrepant scores.

After some discussion on criteria for earning a score of 1 or 2 rather than a score of 0, the two raters were able to score each item slightly more objectively. The raters agreed that a score of 1 was warranted if a response provided more information than was needed to accurately interpret it. For example, the inclusion of "if it's vintage or something" following "decoration" as an alternative use for a barrel earned a participant 1 point, whereas a simple response of "decoration" would have been worth 0 points. Responses that included an optional prepositional phrase or extra information in parentheses may have also earned a score of 1 point. Scores of 2 points were rare, and in most cases they included multiple "extra" pieces of information. For example, a response of "throw to knock down a basketball when it is stuck against the rim" as an alternative use for a shoe earned a participant two points. If this participant had responded "throw to knock down a basketball," a score of 1 may have been warranted, and if he/she had simply responded "throw," no points would have been awarded.

Although there was still some discrepancy between raters after setting more standardized guidelines, once all items were reassessed, final scores resulted in an interrater reliability score of $r = .86$ for the dimension of elaboration. Source information for the Alternative Uses Task is included as Appendix B.

**Demographic and Exercise History Questionnaire.** Finally, consistent with past research (Blanchette et al., 2005), participants were asked to provide their gender, age, height,
weight, academic major, GPA, and exercise history, including number of hours of exercise in a typical week, type of exercise done for typical workouts, and length of time engaging in regular workouts. To create the exercise recency variable, participants were also asked when they most recently exercised, what type of exercise they most recently did, and the duration of their most recent bout of exercise. The recency variable was created based on participants’ response to the question of when they most recently exercised and figured in terms of hours. As much data as possible regarding participants’ exercise habits was collected, but ultimately, only the data that could be quantified in terms of time was used for analysis. For possible exploratory analysis, participants were also asked whether or not they were a student athlete. Because of the low number of respondents who answered “yes” to this question, no further analysis was done using the data. In order to explore any role that diversity may have played, participants were also asked to report their race. The demographic and exercise history items are included as Appendix C.

Procedure

When participants arrived, they were greeted by a researcher who gave them an informed consent form (see Appendix D). Next, they filled out the PANAS-X, which assessed their current mood. This took approximately 5 minutes. After participants filled out the PANAS-X, the researcher described the Alternative Uses task to the participant. Specifically, consistent with past research (Gilhooly et al., 2007) the researcher said, “You will be asked to produce as many different uses as you can think of, which are different from the normal use, for a number of common objects. For example, the common use for a newspaper is for reading, but it could also be used for swatting flies, to line drawers, to make a paper hat and so on. You will have 2 minutes on each object. Its common use will be stated but you are to try to produce possible uses which are different from the normal one and different in kind from each other. Any questions? I
will tell you when to stop on each item. You will have 2 minutes for each item.” The participants were given sheet of paper with the first item listed, and the researcher started a stop watch. After 2 minutes, the researcher told the participants to stop. The participants were then given 2 minutes on the next item. This happened six times for the six items: brick, car tire, barrel, pencil, shoe, and hanger. After completing the Alternative Uses Task, the participants filled out the demographic questionnaire, which included questions about exercise habits. This took approximately 2-3 minutes. Finally, the participants were debriefed (see Appendix E) and thanked for their participation. The total time for the study, from the administration of informed consent through the debriefing, was approximately 30 minutes. The study was reviewed and approved by Xavier University’s Institutional Review Board prior to the onset of data collection (see Appendix F for the IRB approval letter).
Chapter IV

Results

Hypothesis 1 predicted a negative correlation between the amount of time since a participant last exercised and his/her score on the PANAS-X. The shorter the length of time since the most recent bout of exercise, the more positive his/her mood was expected to be. The hypothesis was testing using a Pearson Product-Moment correlation. The hypothesis was not supported, as there was not a significant correlation between the amount of time since a participant last exercised and his or her score on the PANAS-X ($r(96) = .13, p = .20$). Descriptive statistics, as well as a correlation matrix including all continuous variables, are shown in Table 2.

Hypothesis 2 predicted that mood would mediate the relationship between exercise recency and creativity. Because a mediating role of mood was contingent on an observed correlation between exercise recency and creativity, and this relationship was not found ($r(96) = .05, p = .605$), Hypothesis 2 could not be meaningfully tested and is not supported. Hypothesis 3 predicted that exercise regularity would be predictive of creativity above and beyond the effects of exercise recency, and was tested with a two-step hierarchical multiple regression in which exercise recency was entered in the first step, and exercise regularity was entered in the second step. In step two, $\Delta R^2 = .00, F(1, 94) = .04, p = .84$. Therefore, hypothesis 3 was not supported, and in this sample, neither exercise recency nor exercise regularity predicted creativity.
Table 2

*Means, Standard Deviations, and Correlations Among Variables*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tr>
<td>1. Positive Affectivity Total</td>
<td>26.85</td>
<td>7.79</td>
<td>(.89)</td>
<td></td>
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<td></td>
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<tr>
<td>2. Negative Affectivity Total</td>
<td>14.98</td>
<td>5.70</td>
<td>.13</td>
<td>(.87)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3. Exercise Recency (Hours)</td>
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<td>36.03</td>
<td>.13</td>
<td>.08</td>
<td></td>
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<tr>
<td>4. Days Per Week</td>
<td>3.44</td>
<td>1.60</td>
<td>.18</td>
<td>.04</td>
<td>.32**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Hours Per Week</td>
<td>5.76</td>
<td>3.67</td>
<td>.20*</td>
<td>.07</td>
<td>.27**</td>
<td>.76**</td>
<td></td>
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</tr>
<tr>
<td>6. Creativity</td>
<td>74.15</td>
<td>31.21</td>
<td>.18</td>
<td>.03</td>
<td>.05</td>
<td>.08</td>
<td>.01</td>
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*Note: Where appropriate, coefficient alpha reliabilities are reported on the diagonal.  
* p < .05  ** p < .01*
Chapter V
Discussion

The purpose of the present research was to establish a link between exercise and creativity, with enhanced mood (measured with positive affectivity) as a mediating variable. The three hypotheses predicted that there would be a negative relationship between the length of time since participants last exercised and their score on the PANAS-X measure of mood, that mood would be a mediating variable between exercise recency and creativity, and that the extent to which individuals exercise regularly would predict creativity above and beyond the effects of exercise recency. Despite a positive correlation between regular exercise and positive affectivity, the data failed to reveal any relationship between recent exercise and positive affectivity or creativity in this sample. Additionally, hypotheses 2 and 3 assumed a positive correlation between exercise recency and creativity, and because this relationship was not found, these hypotheses could not be meaningfully tested.

Contributions

Although the hypotheses of the present study were not supported, even null results reveal something. Participants were asked when they last exercised, and their responses were quantified by hour. The finding of a positive correlation between exercise regularity (total number of hours per week spent exercising) and positive affectivity but not exercise recency and positive affectivity reveals that either recency has no bearing on affect or the effects of recent exercise diminish quickly. It is possible that if all participants had exercised in the past few hours and
recency had been quantified in intervals of 10 or 15 minutes, there may have been an effect. The utilization of an experimental design in future research will help to control for the amount of time that lapses between exercise and assessment of creativity.

Participants who had recently exercised. Although analysis of the overall sample of 97 participants did not reveal a significant correlation of any sort between creativity and either exercise recency or regularity, when the sample is narrowed down to only those participants who had exercised within the past 12 hours, there is a medium-sized (Cohen, 1992) positive correlation ($r(17) = .29, p = .24$) between exercise regularity (hours per week) and creativity, and a slightly larger positive correlation between exercise regularity as assessed by days per week and creativity ($r(17) = .34, p = .17$). These values are striking because the comparable correlations in the full sample had values of $r(96) = .01$ and $r(96) = .08$. The sample in this case ($n = 18$) is too small for the exploratory correlations to be significant, and they should be interpreted with a great deal of caution, but this finding does open some doors for future research. One possibility that may be suggested through this finding is that the overall positive effects of exercising regularly may be more detectable or heightened shortly after a bout of exercise. When tied back to organizational wellness programs, this not only suggests that organizations should encourage their employees to exercise regularly, but in order to maximize the positive cognitive effects potentially offered through a consistent healthy lifestyle, employees should specifically try to exercise before or during the work day.

Although a sample size of 18 participants is far too small to draw any generalizable conclusions, it is interesting that the relationships between variables were more consistent with some research expectations in the sub-sample of participants who had exercised within the past 12 hours. The time period of 12 hours that was arbitrarily chosen for this analysis may or may
not be the ideal time period to work within, but these findings certainly set the groundwork for additional research.

**PA/Hours per week relationship.** One interesting finding that is consistent with past research is the positive correlation between number of hours spent exercising and positive affectivity for the full sample. Although this is not a new finding in research, it is crucial in the argument for the immediate benefits of corporate wellness programs. Even if the link between exercise and creativity simply does not exist, exercise still has a host of desirable cognitive effects that could easily benefit organizations’ employees and ultimately organizations’ bottom lines. Future research should further explore the cognitive benefits of exercise and specifically the application of these findings in accordance with wellness programs in corporate settings.

**Limitations**

Like all studies, this study is subject to certain limitations. Many studies that have examined the effects of exercise on elements of cognitive functioning have utilized experimental designs, and as such, researchers have been able to control for various factors that cannot be controlled for in a study such as the present study. Conclusions that can be drawn through the results of this study may be limited based on how many participants have exercised recently, how recently they have exercised, and what form of exercise they participated in. Participants’ last bout of exercise was not distributed evenly, whereas in a study with an experimental design, the distribution of participants could be controlled by the researcher.

One critical and ultimately detrimental assumption in the present study was that university students would for the most part be very active and a large proportion of participants would have previously exercised on the day when they participated in the study. However, of the 97 participants whose data was used for analysis, only 18 had exercised within the past 12 hours,
and based on the time of day when data were collected, some of these participants may not have exercised on the same calendar day. It may be safe to assume that participants who had exercised within the past 8 hours did so on the day that they participated in the study, but only 15 out of 97 participants had exercised within the 8 hours prior to participation. Blanchette et al. (2005) looked at the residual effects of exercise on creativity, but they only looked at a time period of up to 2 hours following a bout of exercise. In the present study, only 6 participants had exercised within the past 2 hours. Regardless of when the cut-off should be for how recently a participant should have exercised to be included in analysis, it is likely that the present study included too many participants who had not exercised recently enough to detect effects of exercise on creativity.

Different types of exercise have different physiological effects on the body, and as such, it is likely that they have different psychological effects as well. In the present study, participants reported having participated in many different forms of exercise, which likely resulted in different levels of intensity and different physiological and psychological effects. The data did not show a relationship between exercise and creativity, but past research has revealed a relationship between the two variables (Gondola, 1986, 1987; Blanchette et al., 2005), so even if all participants had exercised in the few hours prior to participation, it is possible that the varying types and levels of exercise included in this study may have confounded the data and prevented a relationship from being detected.

The present study was limited in its use of university students as participants. Overall, the sample of this study had an average age younger than the average age in organizations. University students’ exercise habits may also differ from the average employee’s exercise habits in terms of type, intensity, frequency or duration of exercise. Because positive effects of exercise
on mood have been found following widely varying bouts of exercise, the differences between
the student sample in the present study and the demographic makeup of the general population
should not have confounded the results of this study or its generalizability. However, it certainly
is possible that results could vary depending on the average age of the sample. Because as people
age, many of their cognitive and physical functions slow down, the positive effects of exercise
may be more robust in older populations. Similar future research among a more diverse
population in terms of age may be warranted.

Future Research Directions

The trend toward wellness in the workplace will not stop, but the difficulty of obtaining
upper level management buy-in will likely continue to be a hurdle. Future research on the
immediate benefits of exercise will be beneficial for demonstrating that it does not take years
after implementation and reduced insurance premiums for wellness programs to affect the
bottom line. Any company’s most valuable asset is its employees, and employees who are at the
greatest level of cognitive functioning will undeniably be more productive than employees who
are less cognitively present and engaged.

The length of time that passed since participants last exercised was possibly the greatest
limitation of the present study and it is also a good area of focus for future research. Several
participants’ data were thrown out because they had not exercised recently, and of the remaining
participants, the majority had gone well over a day since they last exercised. Blanchette et al.
(2005) previously looked at the residual effects of exercise on creativity, but they found no
difference in participants whose creativity was measured immediately following 30 minutes of
exercise and those whose creativity was measured 2 hours later. Both of these groups, however,
differed from a control group. This suggests that the cognitive benefits of exercise may last at
least 2 hours, but the present research suggests that they may not last much longer, and they
certainly do not appear to last for multiple days. Future research should expand Blanchette et
al.'s 2-hour period of time and generally do a better job than the current research of controlling
this time period.

Although the main hypotheses of the present study were not supported by the data, the
analysis of a sub-set of participants who had exercised within the past 12 hours revealed
interesting trends that were different enough from the entire sample to warrant future research.
Combined with the findings of Blanchette et al. (2005), these trends make a clear case for
research on the relationships between exercise, positive affectivity, and creativity utilizing
samples of participants who have exercised within the past 2 to 12 hours. The design of this
study introduced several limitations, but with an improved research design, its hypotheses would
be worth revisiting.
Chapter VI

Summary

With obesity on the rise in the United States and a multitude of health problems associated with being overweight, membership in health clubs and fitness centers has become a popular way for people to combat weight gain and maintain healthier lifestyles. In recent years, many organizations have begun to implement wellness initiatives to encourage healthy habits among workers and ultimately among the organization as a whole (Aldana, 2001). It is likely that many of the potential benefits of wellness initiatives are yet to be uncovered. Enhanced creativity among employees may be a direct, yet unanticipated, result of wellness initiatives.

Creativity is a construct that continues to gain attention in research and become more important in industry. Although enhancing creativity is not a primary reason why organizations choose to promote wellness, it may be an inevitable and welcomed secondary outcome experienced as a byproduct of one or more primary outcomes, specifically the ability of exercise to improve morale or mood (Milligan, 2000).

Organizational Wellness Initiatives

Organizational wellness initiatives are programs sponsored by organizations, either on or off-site, that have a goal of promoting health and wellness and identifying and correcting health related problems (Wolfe, Parker, & Napier, 1994). In general, organizational wellness programs fall under two categories—those that involve only a fitness program, such as a gym membership
or an on-site gym, and those that offer educational or health screening opportunities in addition to the fitness component, also known as wellness initiatives (Parks & Steelman, 2008).

Unhealthy employees cost organizations billions of dollars each year. Obesity has been found to be associated with costs related to short-term disability (Burton et al., 1998) and workers’ compensation (Ostbye, Dement, & Krause, 2007). The implementation of programs that promote exercise and healthy choices may decrease many of the obesity-related problems and costs that organizations face.

A review of the literature on wellness initiatives found health promotion programs to be associated with lower levels of absenteeism and health care costs and fitness programs to be associated with reduced health care costs (Aldana, 2001). However, there have been mixed findings regarding the length of time between program implementation and observable change, specifically in terms of healthcare dollars saved (Aldana, 2001). More research on and awareness of some of the immediate effects of exercise and other healthy lifestyle choices may be encouraging for employers that are wary of implementing a program that may not promise an immediate return on investment, but the short-term, day-to-day effects of organizational wellness initiatives have been mostly neglected in research.

Although the idea of an employee taking a break from work to exercise is well in line with the overarching goals of wellness initiatives—to improve employees’ health and wellness—it is different from traditional wellness programs. The effects of physiological changes that happen immediately after exercise may be different from the overall effects of a healthy lifestyle. A person’s mood immediately following exercise is often positively altered (Berger & Motl, 2000), and a positive mood has been associated with a host of desirable outcomes, such as
increased job satisfaction (Kohan & O’Connor, 2002) and an increased prevalence of prosocial behavior (Carlson, Charlin, & Miller, 1988).

**Exercise and Mood**

Mood has been conceptualized as a general affective state that persists for a longer period of time than an emotion, typically lacks an identifiable cause, and is not directed toward anyone or anything specific (Morris, 1989; Thayer, 1989).

Exercise has been shown to enhance mood in a number of different studies, utilizing many different forms of exercise. Furthermore, the effects of exercise on mood have been studied in both clinical and non-clinical populations. Findings have been most robust in non-clinical populations, and one study found exercise to be the best of 10 techniques (for example, watching TV, eating food and consuming alcohol) to enhance mood in a non-clinical population, based on a self-report questionnaire (Thayer, Neuman, & McClain, 1994).

The PANAS-X measures mood from a high level perspective in terms of positive and negative affectivity, and more specifically, in terms of 11 specific affects that make up the constructs of positive and negative affectivity.

Dyer and Crouch (1988) found that running, weight training, and aerobic dance were all positively associated with an enhanced mood over time. Additionally, from the beginning to the middle of the semester, participants in the running group reported a decrease in tension, anger and depression, whereas participants in the control group reported an increase in these factors. If the drop in tension, anger, and depression was attributable to the increase in frequency and consistency of exercise, then an organization that implements a wellness program with a fitness component may very well see a drop in these factors among participating employees shortly after implementation.
Overall, the empirical support for the ability of various forms of exercise to enhance mood and reduce stressors is robust and well established. As the next two sections will discuss, creativity has become important for organizations to stay ahead of competition, and exercise-induced enhanced mood may lead to higher levels of creativity.

**Creativity**

Although one agreed-upon definition of creativity does not seem to exist (Mumford, 2003), researchers agree that creativity involves the generation of ideas, insights, or problem solutions that are both novel and potentially useful (Amabile, 1983). For the general population, including workers in organizations, the ability to think creatively on a day-to-day basis may be affected by many different factors, including mood.

**Mood and Creativity**

Research has largely supported a link between mood and creativity. Seminal work by Isen and colleagues (Isen & Daubman, 1984; Isen, Daubman, & Nowicki, 1987; Isen, Johnson, Mertz, & Robinson, 1985) in the 1980’s revealed the relationship between mood and creativity. In an early study, Isen and colleagues (1987) manipulated mood through watching a film. They found that participants in the positive mood condition produced more solutions to a creativity task than did participants in the neutral mood condition, $\chi^2(1, N = 27) = 8.19, p < .01$.

The effect of mood on creativity has been further explored and further supported many times since then (Isen & Baron, 1991; Mumford, 2003). Essentially, those in a positive mood are more likely to display creativity than those in a neutral mood (Shapiro & Weisberg, 1999; Richards, 1994). A meta-analysis by Baas, de Dreu, and Nijstad (2008) synthesized mood-creativity research. Findings supported the hypothesis that positive moods produce more creativity than mood-neutral controls.
For organizations, especially those that value creativity, these findings are important. If organizations can find ways to enhance the moods of employees while they are at work, they may in turn succeed in developing more creative employees. The following section will review exercise as one possible way that organizations may go about enhancing employees’ moods and the effects that at least one researcher has found exercise to have on creativity.

**Exercise, Mood, and Creativity**

Research measuring a direct link between exercise and creativity is sparse. Gondola (1986, 1987) first considered the relationship based on the established link between exercise and other aspects of cognition. In order to explore a possible link between exercise and creativity, Gondola (1986) conducted several studies using students in physical education classes. She tested the impact of consistent exercise on creativity, as measured by the Alternative Uses Task (Guilford, 1967) with scores on alternative uses, remote consequences, and obvious consequences.

Guilford’s (1967) Alternative Uses Task is a task in which participants are given a series of common objects and asked to think of as many uses apart from the intended use as they possibly can in a specified period of time. Responses are often scored based on four separate dimensions—originality, fluency, flexibility, and elaboration.

Gondola (1968) found that compared to scores on a pre-test, after students had been consistently running for 20 minutes twice a week for a semester, scores on a post-test were significantly higher. She also compared pre-test scores with scores from a post-test taken immediately following a 20-minute run, and found that scores on the post-test were significantly higher. In another study, Gondola (1987) successfully replicated her findings using aerobic dance. Blanchette, Ramocki, O’del, and Casey (2005) replicated Gondola’s (1986, 1987)
findings that exercise can positively influence creativity, and they extended the area of research to consider the immediate and residual effects of exercise. They found no difference in creative potential between participants who were tested immediately following 30 minutes of moderate aerobic exercise and participants who were tested 2 hours after the completion of exercise. Both groups demonstrated significantly more creative potential than participants in the group that participated in no exercise. These findings both support the theory that exercise enhances creativity and suggest that cognitive functioning, specifically in terms of creativity, is positively affected for at least 2 hours following exercise.

Although enhancing mood during the work day has not been considered one of the primary purposes for wellness initiatives, it may be a positive benefit enjoyed by organizations that allow employees to take time during the work day to exercise. In turn, enhanced mood may play a role in a greater capacity for creativity, resulting in more novel products and services and greater profitability.

**Rationale and Hypotheses**

As organizations implement wellness initiatives and encourage employees to exercise and maintain overall healthier lifestyles, they may be pleasantly surprised by the other organizational benefits that come along with healthier employees and lower healthcare costs. Considering past research, the following is hypothesized:

Hypothesis 1: There will be a negative relationship between length of time since participants last exercised and score on the PANAS-X measure of mood.

With strong direct relationships between exercise and mood, and mood and creativity, and some support in the literature for a link between exercise and creativity (Gondola, 1986,
1987; Blanchette et al., 2005), it can be expected that a relationship between exercise and creativity may exist and may be detected, attributable to mood as a mediating variable.

Hypothesis 2: Mood will mediate the relationship between exercise recency and creativity.

Considering that creativity on a task may be manipulated through the manipulation of mood, overall creative capacity may be enhanced through consistent exercise. Because overall exercise history and recency of exercise are distinct variables that may be influenced by organizations in different ways, assessing their relative effects on creativity seems warranted.

Hypothesis 3: The extent to which an individual exercises regularly will be predictive of creativity above and beyond the effects of exercise recency.

Method

Participants. Participants for this study were university students enrolled in a psychology course who participated either for course credit or extra credit. They were recruited through the Xavier University Psychology Department’s participant pool. Originally, 115 students participated. After eliminating 18 participants for various reasons, data from 97 participants was used for analysis.

Participants ranged in age from 18 to 24 years with a mean age of $M = 20.36$ years ($SD = 1.31$ years), and of the 97 participants, 47 identified as male and 50 identified as female. The breakdown of participants in terms of age, race, and gender is displayed in Table 1.

Measures and Materials. The measures and materials are described next.

Positive and Negative Affect Schedule - Expanded Form. Mood was assessed using Positive and Negative Affect Schedule - Expanded Form (Watson & Clark, 1994). The PANAS-X consists of 60 items, half of which measure positive affectivity and half of which measure
negative affectivity. Both the positive affectivity and negative affectivity scales were found to be internally consistent with alphas of .89 and .87, respectively. For the purposes of the present research, both scales were administered, but only positive affectivity scores were used for analysis.

*Alternative Uses Task.* The Alternative Uses Task (Guilford, 1967) was used to assess participants' creativity. This task and tasks like it have been widely used in creativity research (Chamorro-Premuzic, 2006). It is a creativity task that specifically measures divergent thinking ability, which is the ability to think of many uses for a single item, where responses are often novel and lead to a broad perspective (Guilford, 1967). It provides participants with several common objects, and participants are asked to generate as many uses for the object as possible in a short period of time. The uses generated are assessed based on four dimensions—originality, fluency, flexibility and elaboration.

*Demographic and Exercise History Questionnaire.* Finally, consistent with past research (Blanchette et al., 2005), participants were asked to provide their gender, age, weight, academic major, GPA, and exercise history, including number of hours of exercise in a typical week, type of exercise done for typical workouts, and length of time engaging in regular workouts. To create the exercise recency variable, participants were also asked when they most recently exercised, what type of exercise they most recently did, and the duration of their most recent bout of exercise. Participants were also asked whether or not they were a student athlete. In order to explore any role that diversity may have played, participants were also be asked to report their race. The demographic and exercise history items are included as Appendix C.

*Procedure*
Discussion

The purpose of the present research was to establish a link between exercise and creativity, with enhanced mood (measured with positive affectivity) as a mediating variable. Despite a positive correlation between regular exercise and positive affectivity, the data failed to reveal any relationship between recent exercise and positive affectivity or creativity in this sample.

Contributions. Although the hypotheses of the present study were not supported, even null results reveal something. Participants were asked when they last exercised, and their responses were quantified by hour. The finding of a positive correlation between exercise regularity and positive affectivity but not exercise recency and positive affectivity reveals that either recency has no bearing on affect or the effects of recent exercise diminish quickly.

Participants who had recently exercised. Although analysis of the overall sample of 97 participants did not reveal a significant correlation of any sort between creativity and either exercise recency or regularity, when the sample is narrowed down to only those participants who had exercised within the past 12 hours, there is a medium-sized (Cohen, 1992) positive correlation ($r = .29, p = .24$) between exercise regularity (hours per week) and creativity, and a slightly larger positive correlation between exercise regularity as assessed in days per week and creativity ($r = .34, p = .17$). The sample in this case ($n = 18$) is too small for the exploratory correlations to be significant, and they should be interpreted with a great deal of caution, but this finding does open some doors for future research. One possibility that may be suggested through this finding is that the overall positive effects of exercising regularly may be more detectable or heightened shortly after a bout of exercise.
Although a sample size of 18 participants is far too small to draw any generalizable conclusions, it is interesting that the relationships between variables were more consistent with some research expectations in the sub-sample of participants who had exercised within the past 12 hours.

*PA/Hours per week relationship.* One interesting finding that is consistent with past research is the positive correlation between number of hours spent exercising and positive affectivity for the full sample. Even if the link between exercise and creativity simply does not exist, exercise still has a host of desirable cognitive effects that could easily benefit organizations’ employees and ultimately organizations’ bottom lines.

**Limitations.** Conclusions that can be drawn through the results of this study may be limited based on how many participants have exercised recently, how recently they have exercised, and what form of exercise they participated in. Participants’ last bout of exercise was not distributed evenly, whereas in a study with an experimental design, the distribution of participants could be controlled by the researcher.

One critical and ultimately detrimental assumption in the present study was that university students would for the most part be very active and a large proportion of participants would have previously exercised on the day when they participated in the study. However, of the 97 participants whose data was used for analysis, only 18 had exercised within the past 12 hours, and based on the time of day when data were collected, some of these participants may not have exercised on the same calendar day. Regardless of when the cut-off should be for how recently a participant should have exercised to be included in analysis, it is likely that the present study included too many participants who had not exercised recently enough to detect effects of exercise on creativity.
Different types of exercise have different physiological effects on the body, and as such, it is likely that they have different psychological effects as well. In the present study, participants reported having participated in many different forms of exercise, which likely resulted in different levels of intensity and different physiological and psychological effects. It is possible that the varying types and levels of exercise included in this study may have confounded the data and prevented a relationship from being detected.

The present study was limited in its use of university students as participants. Overall, the sample of this study had an average age younger than the average age in organizations. However, because positive effects of exercise on mood have been found following widely varying bouts of exercise, the differences between the student sample in the present study and the demographic makeup of the general population should not have confounded the results of this study or its generalizability.

Future Research Directions. The trend toward wellness in the workplace will not stop, but the difficulty of obtaining upper level management buy-in will likely continue to be a hurdle. Future research on the immediate benefits of exercise will be beneficial for demonstrating that it does not take years after implementation and reduced insurance premiums for wellness programs to affect the bottom line. Any company's most valuable asset is its employees, and employees who are at the greatest level of cognitive functioning will undeniably be more productive than employees who are less cognitively present and engaged.

The length of time that passed since participants last exercised was possibly the greatest limitation of the present study and it is also a good area of focus for future research. Blanchette et al. (2005) previously looked at the residual effects of exercise on creativity, but they found no difference in participants whose creativity was measured immediately following 30 minutes of
exercise and those whose creativity was measured 2 hours later. Both of these groups, however, differed from a control group. This suggests that the cognitive benefits of exercise may last at least 2 hours, but the present research suggests that they may not last much longer, and they certainly do not appear to last for multiple days. Future research should expand Blanchette et al.'s 2-hour period of time and generally do a better job than the current research of controlling this time period.

Although the main hypotheses of the present study were not supported, the analysis of a sub-set of participants who had exercised within the past 12 hours revealed interesting trends that were different enough from the entire sample to warrant future research. The design of this study introduced several limitations, but with an improved research design, its hypotheses would be worth revisiting.
References


ENHANCING CREATIVITY THROUGH EXERCISE


doi:10.1177/00218863940301002
Appendix D

Informed Consent Form

You are being given the opportunity to volunteer to participate in a project conducted by Laura Gormas through Xavier University. The purpose of this study is to investigate the potential impact of organizational programs on employee functioning.

In this study, you will answer short survey, complete a task, and fill out a demographic questionnaire. Your participation will take around 30 minutes to complete.

There are no known risks associated with this study. Participation in this study is entirely voluntary. You are free to withdraw from the study at any time without penalty. Refusal to participate in this study will have no effect on any future services you may be entitled to from Xavier University. You have to be at least 18 years old to participate in this study.

Your responses will remain confidential. Moreover, only the researchers conducting this study will have access to your responses. Your name will be collected only to ensure that you receive proper credit for participating, and will never be connected to any of your responses in any way.

If you have any questions at any time during the study, you may contact the principal investigator, Laura Gormas, at gormasl@xavier.edu, or the faculty advisor, Dr. Morrie Mullins, at mullins@xavier.edu. Questions about your rights as a research subject should be directed to Xavier University’s Institutional Review Board at 513-745-2870.

By signing below, you agree to the following statement: I have been given information about this research study and its risks and benefits and have had the opportunity to ask questions and to have my questions answered to my satisfaction. I freely give my consent to participate in this research project.

Participant Signature: ________________________________ Date: ___/___/___
Appendix E

Debriefing Form

Thank you for participating in our research project. The purpose of this study is to investigate the effects of exercise, both recent and habitual, on creativity and to explore the role of mood as a link between exercise and enhanced creativity.

Please do not discuss the specifics of our study with anyone or distribute this form to any potential participants, as data collection is ongoing. If you have any questions or concerns, or if you would like to inquire about the results of this study, please contact the principal investigator, Laura Gormas, at gormasl@xavier.edu, or the faculty advisor, Dr. Morrie Mullins, at mullins@xavier.edu.
November 26, 2012

Laura Gormas
1363 Bluff Ave. Unit B
Grandview Heights, OH 43212

Re: Protocol #1238, Organizational Programs and Creativity

Dear Ms. Gormas:

The IRB has reviewed the materials regarding your study, referenced above, and has determined that it meets the criteria for the Exempt from Review category under Federal Regulation 45CFR46. Your protocol is approved as exempt research, and therefore requires no further oversight by the IRB. We appreciate your thorough treatment of the issues raised.

If you wish to modify your study, including the addition of data collection sites, it will be necessary to obtain IRB approval prior to implementing the modification. If any adverse events occur, please notify the IRB immediately.

Please contact our office if you have any questions. We wish you success with your project.

Sincerely,

[Signature]

Kathleen J. Hart, Ph.D., ABPP
Vice Chair, Institutional Review Board
Xavier University

KJHrb
C. Morrie Mullins, Adviser