Abstract

Impact of Reading for Pleasure Versus School During Exercise on Affective State Responses

by

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Based on the distraction hypothesis, an acute exercise session provides a time out from life stress and serves as an explanation for why exercise potentially improves affect. It is plausible that not all exercise settings provide a distraction from life stress. Enjoyable and attention absorbing exercise experiences may provide a stronger distraction and time out from daily stresses and worries than exercise that is less enjoyable or attention absorbing. Therefore, the purpose of the present study was to compare reading for pleasure versus school on affective state responses, enjoyment, and attentional focus. Thirty six active college students (15 males, 21 females) completed two moderate intensity exercise sessions, one session per reading condition. Affective responses were measured pre, mid, post, and 60 minutes post each exercise session. Enjoyment and attentional focus were measured post exercise. Through a series of repeated measures ANOVAs, results showed pleasure reading resulted in more positive feelings during exercise whereas textbook reading resulted in participants feeling slightly worse during exercise compared to baseline. Both groups felt better post exercise; however the magnitude of change for

affective valence and positive engagement was larger when reading for pleasure. Responses for activation, energy, revitalization, tension, tiredness and physical exhaustion improved over time and were similar between the two groups. No changes in calmness or tranquility were observed pre to post. Activation, calmness, tension, energy, positive engagement and revitalization responses decreased towards baseline levels 60 minutes post exercise with energy responses lower than baseline. However, affective valence continued to increase for the school reading group and was maintained for the pleasure reading group 60 minutes post exercise. Participants reported greater enjoyment and attentional focus when reading for pleasure versus school. Additionally, correlation analysis showed enjoyment and attentional focus were related to post exercise affective valence, arousal, energy, revitalization, and positive engagement with the correlations being in the moderate range. These findings support that reading for pleasure while exercising is more enjoyable and attention focusing resulting in more positive affective responses, thus reading for pleasure may provide a stronger distraction compared to reading material that is related to daily life stress.

IMPACT OF READING FOR PLEASURE VERSUS SCHOOL DURING EXERCISE ON AFFECTIVE RESPONSES

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CHAPTER 1: INTRODUCTION

A substantial amount of research has shown that exercise can result in positive affective changes (Arent, Landers, & Etnier, 2000; Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991). An acute bout of exercise can not only reduce negative affective states such as tension, tiredness, fatigue, and depression (Bartholomew & Miller, 2002; Kennedy & Newton, 1997; Nelson & Morgan, 1994; Thayer, 1987) but it can also increase positive affect such as feelings of vigor and energy (Bellezza, Hall, Miller, & Bixby, 2009; Kennedy & Newton, 1997; Rejeski, Gauvin, Hobson, and Norris, 1995; Thayer, 1987; Turner, Rejeski, & Brawley, 1997). Investigating affective responses to exercise is important as doing so may provide insights on how to structure exercise to promote adherence as well as mental health.

Currently, an approximate 60% of U. S. adults are insufficiently active and 25% are not active at all (Centers for Disease Control, 1999). With alarming numbers such as these, the difficult task of getting the population more active is a growing concern. Understanding affective responses to acute exercise may develop insights on how to structure exercise to provide positive experiences that foster continued activity involvement. Affective responses to acute exercise may influence subsequent exercise participation as many people report exercising for mood related benefits (McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003; Thayer, Newman, & McClain, 1994). In fact, research shows that positive affective changes associated with acute exercise relate to enhanced motivation to exercise in the future (Focht, 2009; Raedeke, Focht, & Scales, 2007). Examining the impact of exercise on transient indicators of psychological well-

being may also provide insights on how to optimally structure exercise to promote mental health. The long term effects of exercise on mental health are surmised to be due, in part, to repeated exposure to acute exercise (Gauvin & Rejeski, 1993).

Exercise-related affective changes are also robust across a wide variety of populations (e.g., age and gender; Ekkekakis, Hall, & Petruzzello, 2008; Parfitt, Markland, & Holmes, 1994). A considerable amount of research has examined how different factors of the exercise experience (e.g. setting, intensity, duration) may impact affective responses. Positive affective changes occur across a wide variety of exercise contexts (e.g., lab/naturalistic, self-selected/prescribed intensity; Ekkekakis & Lind, 2006; Focht, 2002; Focht, 2009; McAuley, Mihalko, & Bane, 1996). This research also shows that moderate intensity exercise is sufficient to elicit positive affective changes while high intensity may negate positive affective changes, especially during exercise (Ekkekakis, Hall, & Petruzzello, 2008; Parfitt, Markland, & Holmes, 1994).

Current research findings support that affective responses during exercise may fluctuate and post exercise measurement times may not capture those responses (Hall, Ekkekakis, & Petruzzello, 2002). It is recommended by researchers to measure affect during exercise since affective responses can vary throughout the session (Gauvin & Rejeski, 1993). However, few studies have measured affect during exercise. Also, little is known about lasting effects of exercise. Of the few studies to do so, Thayer (1987) measured affect 60 and 120 minutes post exercise and affective improvements were maintained from 30 minutes post walking. Overall, research surrounding the fluctuations of affective responses during and extended post test periods remain unclear.

Although an acute bout of exercise is often associated with improved affect, the reasons why exercise potentially influences affect is not well understood. One hypothesis is the distraction hypothesis. This theory states that exercise provides a time out from life stress and daily worries, thereby improving affective states. Barhke and Morgan (1978) developed this hypothesis based on the results of their study aimed at examining how exercise and meditation impact anxiety. Participants reported significantly lower anxiety after 20 minutes of walking on a treadmill, relaxation, or quiet rest sitting in a recliner. The decrease in anxiety was similar across all three groups leading the researchers to conclude that all three activities distracted participants from their life stress. They took a time out to exercise, perform relaxation therapy, or sit quietly in a recliner, thereby improving affect. This general finding was replicated by Raglin and Morgan (1985).

Both exercise and participation in a distracting activity result in immediate improvements in affect. However, the duration of the affective benefits is not well understood. For example, exercise has been shown to result in longer decreases in anxiety compared to meditation (Raglin & Morgan, 1987). However, they did not assess whether exercise or a distracting activity differentially influenced positive affect. In a more recent study, Focht and Hausenblas (2001) had two groups included in this study and participants were randomized to one of two groups. One group exercised in a natural setting and the other group sat quietly. Participants in both settings showed reductions in anxiety and increases in tranquility immediately post exercise and quiet rest. Both conditions also showed increases in positive engagement and revitalization 30 minutes

post exercise/quiet rest. Additional research is needed to clarify the duration of changes in both positive and negative affect based on the distraction hypothesis.

The distraction hypothesis has been supported by research to be a very possible explanation of why exercise improves affect. However, research also shows that not all exercise experiences produce the same results.

Based on the distraction hypothesis, if exercise does not provide time out from daily worries and stresses then affect should not improve. Support for this assertion has been found in a study by Breus and O'Connor (1998). In this study a sample of high trait anxious college-aged females (n=18) were recruited. Each participant completed four sessions including exercise for 20 minutes, exercise and studying for 40 minutes, studying only for 40 minutes, and a control condition involving quiet rest while sitting on an exercise bike. According to the distraction hypothesis, the exercise group and the quiet rest group should see improvements in affective responses. Exercise was completed at a low intensity (40% of VO_2 max) performed on a cycle ergometer. Anxiety was measured pre and post each condition. Results showed that anxiety was reduced in the exercise only condition. The study conditions did not see a decrease in anxiety supporting the distraction hypothesis because the participants were not given a break from daily stresses. While no decreases in anxiety were reported in the quiet control group, which is inconsistent with the findings of Bahrke and Morgan (1978), it is important to note that participants were to sit on the cycle ergometer for 40 minutes so the lack of change in affective responses could be due to sitting uncomfortably for that length of time.

In further study of the distraction hypothesis, Russell, Pritschet, Frost, Emmett, Pelley, Black, and Owen (2003) performed a study to examine how a distraction activity during exercise such as reading or watching a video would impact affective responses since those activties would potentially provide a greater distraction and time out from life stress. Participants were assigned to one of three groups which included: a) exercise and watching a health video, b) exercise and reading health material, or c) an exercise only with no distraction. Each group showed similar improvements in affect. Russell, et al. (2003) suggested the results revealed that a distraction during exercise may not be sufficient to increase the magnitude of the enhanced affective responses. Additionally, participants may not have focused on the reading or the video while exercising which was hypothesized to provide a greater distraction. This study raises the issue of whether a distraction that is enjoyable and attention absorbing may provide a more positive experience, therefore improving upon the affective responses to the exercise session. Exercise that is not enjoyable or attention absorbing may not provide a time out from daily stress.

Enjoyable, attention absorbing activities will likely provide a stronger distraction from life stress than activities that are less enjoyable or attention absorbing. Research has not yet examined this issue. However, research has examined the role of enjoyment in understanding affective responses to exercise. Raedeke (2007) found enjoyment to be related to pre to post increases in positive affect. Interestingly, enjoyment did not relate to decreases in negative affect.

In addition, researchers have found that social-environmental factors influence both enjoyment and affective responses (Focht, 2009, Raedeke, Focht, & Scales, 2007). Walking outdoors resulted in more positive affective responses and higher enjoyment compared to indoor walking on a treadmill (Focht, 2009). Enjoyment was also positively correlated with improved positive affective responses during outdoor walking. Furthermore, Raedeke, Focht and Scales (2007) found enjoyment to mediate the relationship between leadership style and affective responses for females in a fitness class. When the leadership style was health oriented, participants reported higher enjoyment and more positive affective responses. In comparison, when leader behavior was physique oriented, participants reported lower enjoyment and lower improvements in affect.

Problem Statement

Given the existing literature on enjoyment and the distraction hypothesis, an acute bout of exercise that is enjoyable and attention absorbing may provide a stronger distraction and time out from daily stresses and worries than exercise that is less enjoyable or attention absorbing. Theoretically, reading for pleasure during exercise may be enjoyable and attention absorbing and thus provide a time out from daily life stress and result in positive affective changes during and post exercise. Conversely, reading school related materials may not provide a distraction or time out from life stress and thus results in less positive affective changes during and post exercise. Furthermore, how long the affective improvements last after exercise is also unclear in the research literature and warrants further clarification.

Therefore, the current study was designed to compare affective responses to an acute bout of exercise that was designed to enhance enjoyment and attentional focus (i.e., reading for pleasure) versus an acute bout of exercise that was designed to not provide a distraction from life stress (reading school related material). In addition, since few studies have examined the duration of affective benefits following acute exercise, affect will be measured 60 minutes post exercise in addition to pre, during, and immediately post exercise.

Hypotheses

One hypothesis of the current study is that participants will show increased positive and decreased negative affect following an acute bout of exercise. However, reading for pleasure while exercising should result in more positive affective state changes during, immediately post and 60-minutes post exercise compared to reading school materials during exercise. A second hypothesis is that participants will report higher enjoyment and attentional focus during the pleasure versus school reading condition. Finally, the third hypothesis is that enjoyment and attention will be more strongly correlated with increases in positive affect versus decreases in negative affect.

Limitations

The following limitations apply to the present study:

1. Small sample size for the 60 minute post data.
2. A quiet rest control group was not included.
3. Time of day was not controlled for the two exercise sessions.
4. Only students enrolled in Lifetime Physical Activity courses at East Carolina University participated.

Delimitations

Listed below are the delimitations of the study:

1. Participants needed to be regularly active.
2. Participants need to be able to read during exercise.
3. Participants needed to be healthy with no medical contraindications to exercise.
4. College students from East Carolina University were recruited.
5. Participants performed two 30 minute exercise sessions, one session for each reading condition (pleasure reading and school textbook reading).
6. Only moderate intensity was performed.
7. Data collection was completed near the week of finals.

Definition of Terms

For the purpose of this study, the following terms are defined:

- Absorption: This term refers to how engaged participants were in the reading.
- Activation: Based on the dimensional affect, activation refers to how aroused (low arousal – high arousal) participants feel resulting from exercise.
- Affect: A general, automatic response to a stimulus eliciting feelings of good-bad/pleasure-displeasure.
- Affective valence: Based on the dimensional approach to affective responses, affective valence refers to how pleasant/good – unpleasant/bad people feel as a result of exercise.
- Attention: The amount of attention the participant had toward the reading. This term includes absorption into the reading, focus in comprehending the reading, and distraction the reading provided from the daily stresses and worries while exercising.
- Calmness: The calmness subscale of the Stress/Arousal Adjective Checklist refers to feelings of pleasantness and low activation.
- Distraction: This term refers to the extent for which the reading diverted participants' attention away from life stress.
- Emotions: Emotions (e.g. guilt, fear) occur following mental processing that attaches some meaning to an event.
- Energy: The energy subscale of the Stress/Arousal Adjective Checklist refers to feelings of pleasantness and high activation.

- Enjoyment: Positive response to the movement experience that reflects feelings such as pleasant, liking, and fun derived from an activity.
- Exercise: A form of leisure-time physical activity that is performed with a goal of achieving a particular benefit such as health or cardiovascular endurance.
- Focus: This term refers to how much the participants comprehended the reading during exercise.
- Moderate intensity: According to the Centers for Disease Control, moderate intensity corresponds to a heart rate between 50% and 70% of age-predicted max heart rate.
- Moderator: Characteristics of an individual (e.g. age, gender) that influences the exercise and affect relationship.
- Moods: Subjective states (e.g. irritation, cheerfulness) that have a cognitive basis, and can enhance or interfere with behavior. Moods last for longer periods of time compared to emotions and can come and go without a specific cause.
- Physical Exhaustion: Feelings such as fatigue or being worn out in response to exercise.
- Pleasure reading: For this study, the pleasure reading consisted of a book or novel the participant enjoyed reading.
- Positive Engagement: Refers to feelings such as happy and up-beat in response to exercise.
- Revitalization: Refers to feeling revived or refreshed in response to exercise.

- School reading: For this study, the school reading consisted of textbook reading the student needed to complete for a class. The textbook could not be health or fitness related.
- Tension: The tension subscale of the Stress/Arousal Adjective Checklist refers to feelings of unpleasantness and high activation.
- Tiredness: The tiredness subscale of the Stress/Arousal Adjective Checklist refers to feelings of unpleasantness and low activation.
- Tranquility: Refers to feeling relaxed or peaceful in response to exercise.

CHAPTER 2: LITERATURE REVIEW

A major challenge in America today is getting people to live an active lifestyle. This very challenge has been the subject of a large body of research where investigators have examined ways to get inactive individuals to become active. The physical activity promotion challenge of helping individuals achieve long term exercise habits may be explained by these affective responses felt from an acute bout of exercise. If a single exercise session can be structured to enhance affective responses this may help with exercise related motivation. Long term mental health benefits may be in part due to an accumulation of short bouts. If people begin to feel better in terms of mental health resulting from exercise, then they may continue to be chronically active.

Understanding affective responses to exercise may help shed light on how to make the exercise session more pleasant for individuals. Research examining mental health has and will reveal what potential factors may or may not enhance affective responses. Currently, how to structure an exercise session to optimally improve affective responses is not well understood. By examining affective responses to acute exercise clarifies this issue.

In the coming sections, the nature of affect will be explained and the existing research on its relationship to exercise will be examined. Measurement considerations, individual characteristics, intensity and duration of exercise will be reviewed as it relates to affective responses. Additionally, social psychological factors, the distraction hypothesis, and enjoyment and the connection affective states have with each will be

discussed. By thoroughly understanding affective responses as known by current research, the basis for the present study will be revealed.

Categorical and Dimensional Views of Affect

Before examining how exercise and affect are related it is important to understand the nature of affect. Although the terms affect, mood, and emotions are often used interchangeably they reflect distinct psychological states. Moods usually last for a prolonged period of time and sometimes do not have a distinct cause (e.g. , happy or irritated). Moods tend to be constant without variation. In contrast, emotions are feeling states brought about by cognitive processes following an event, object or person that is impactful to the individual (e.g. feelings of anxiety before a performance in front of an audience). Emotions have a specific cause and do not last long like moods. Affect, like emotions, are responses to a stimulus. However, the response is immediate and automatic without substantial, or any, cognitive appraisal. Affective responses can be either positive or negative. Positive affect refers to feelings of pleasure, calmness, or energy in response to a stimulus. Negative affect can be described as feeling tired, tense, or nervous (Lox, Ginis and Petruzzello, 2006). In conclusion, moods can change with or without a specific reason whereas emotions occur in reaction to something such as bad news for example. Both require cognitive awareness and processes, but affect refers to the reflexive reaction to a stimulus, such as exercise, with minimal cognitive input (Lox, Ginis & Petruzzello, 2006). Knowing the difference between moods, emotions and affective feeling states is important because while the terms are related, they have distinct properties and should

not be confused. Moreover, understanding the differences helps clarification when measuring and evaluating psychological responses to exercise.

To further comprehend the nature of affect, the organization of affective responses should be examined. Affect is considered to be hierarchically structured and ought to be assessed at the multiple levels. The higher-order level consists of global valence (pleasant/unpleasant) and activation (high or low) dimensions as pictured in Figure 1. The valence and activation dimensions of all affective responses can be plotted in one of the four quadrants as shown in the figure below of the circumplex model: pleasant high activation (e.g., excitement, energy), pleasant low activation (e.g., calmness, relaxation), unpleasant low activation (e.g., boredom, fatigue), or unpleasant high activation (e.g., tension, distress). Finally, the lower-order level of affect consists of distinct, specific categorical affective states (Tellegen, Watson, & Clark, 1999). The circumplex model of dimensional affect is useful because of its broad range and balance of both positive and negative affect. This model provides a useful framework for studying the effects of various exercise stimuli on affect (Lox, Ginis, & Petruzzello, 2006; Tellegen, Watson, & Clark, 1999). Additionally, categorical states provide insight into specific and individual feeling states impacted by exercise. While researchers debate whether affect should be measured dimensionally or categorically, a common approach is to measure at multiple levels to gain insight on overall affect as well as the distinct content experienced from exercise.

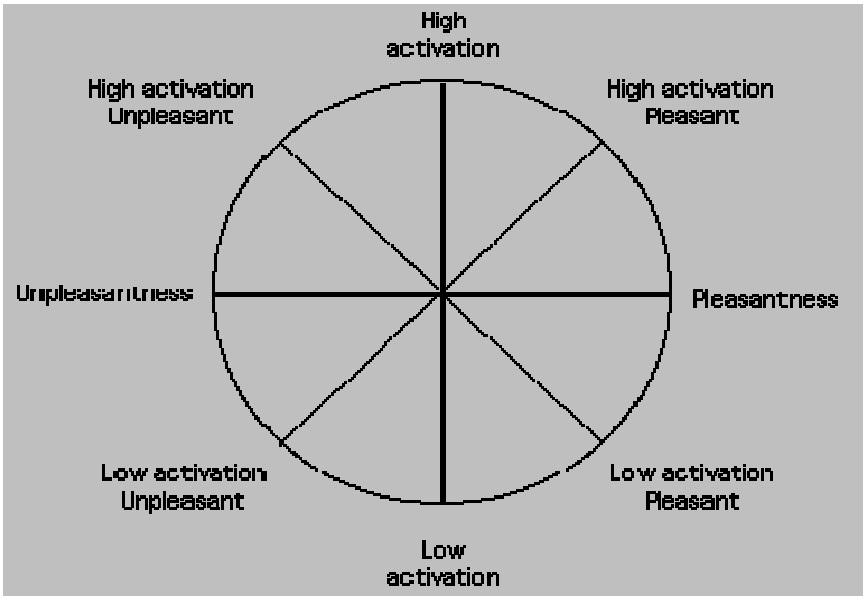

Figure 1: Circumplex Model - www.public.iastate.edu/~ekkekaki/research.html

Relationship between Exercise and Affect

The relationship between exercise and affect is not yet completely understood. In the first studies examining this relationship, only negative affect was measured. Researchers focused on how exercise reduced negative affect, especially in clinical populations. In a small sample of adult depressed women, Doyne, Chambless, and Beutler (1983) examined whether aerobic exercise could lower depression. For the first 2-3 weeks of the study, participants served as their own baseline-control group by going to the clinic 4 times weekly and sitting quietly in an office for 30 minutes. For the next six weeks, these women exercised for 30 minutes four times per week on a cycle ergometer. Each day participants filled out the Depression Adjective Checklist (DACL)

that measures depressed affect. Results showed that depression was significantly lower compared to baseline throughout the weeks of the exercise intervention.

In a larger study with 40 clinically depressed individuals, Doyne, Ossip-Klein, Bowman, Osborn, McDougall-Wilson, and Neimeyer (1987) randomly assigned participants to one of three, eight week conditions including running, weight lifting, and a control condition. All exercise sessions were supervised by undergraduate research assistants and participants completed three or four sessions per week. A battery of questionnaires measuring depression were administered to the exercise groups and the control group at baseline, midpoint, and post intervention as well as 1, 7, and 12 months post treatment. Significantly lower depression scores were observed for both exercise groups at each measurement period and scores were significantly lower than the control condition participants.

In addition to examining the effect of exercise on depression, exercise and its ability to reduce anxiety was also of much interest in early research examining affective state responses to exercise. Lion (1978) examined how cardiovascular conditioning influenced anxiety in a sample of three psychiatric patients as compared to a control group. Participants were taken to the local boardwalk where they jogged at least one mile on three or more days each week for two months. The control group was taken to the boardwalk the same amount of times as the exercise group, but did not exercise. Lion found that posttest scores at the conclusion of the two months revealed a significant reduction in anxiety as compared to the control group using the State-Trait Anxiety Inventory (STAI) which measures anxiety.

Similar results were found by Steptoe, Edwards, Moses, and Matthews (1989) in a study comparing the psychological effects of aerobic training (n=24) and an attention-placebo strength training/flexibility control group (n=23) in highly anxious individuals recruited from the general public. Participants completed four exercise sessions per week for 10 weeks. The exercise group performed 30 minutes of brisk walking or jogging starting with a warm up and ending with a cool down. The control group performed discontinuous exercise in an exercise room for about 20 minutes but they did not exceed a heart rate of 50% HR max. All participants completed the STAI as well as the Profile of Mood States (POMS) pre and post the training period. The POMS measures six mood states including tension, depression, anger, vigor, fatigue, and confusion. Greater reductions in tension and anxiety scores were observed in the aerobic training group compared to the attention control group. Although not evaluating affective responses to acute exercise, through the years the mounting research supports that exercise training reduces anxiety and depression.

Since then a growing body of knowledge reveals that exercise participation is linked to reduced depression and anxiety in large scale population based studies (Goodwin, 2003; Stephens, 1988) as well as clinical trial research (Blumenthal, et al., 1999; Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005). In fact, research comparing exercise to other treatment modalities such as anti-depressant medications finds that exercise participation is as effective as more standard treatments. Likewise, research has also shown that exercise is as effective as traditional stress management counseling in the treatment of stress and anxiety (Berger, Pargman, & Weinberg, 2002).

Although many of the earlier studies examined the effects of exercise on relatively long-term mental health outcomes, other studies examined the effect of exercise on more transient indicators of psychological well being including affective states such as anxiety and other negative states measured by the POMS. However, a recent trend has been to not only examine negative affect, but also positive affective state responses to exercise. While reductions in negative affect are important in clinical populations, for the general population the increases in positive affective responses to exercise may be more pronounced than reductions in negative affect. Also, understanding the effect of exercise on positive affective states is important because mental well-being is not simply the absence of negative affect, it is also the presence of positive affect which is an indicator of psychological well-being.

In one of the first studies to examine the impact of exercise on positive affect, Thayer (1987) compared affective responses to sugar snacking and brisk walking. Participants (n=18) rolled a die and depending on the number rolled they either ate a chocolate bar or took a 10 minute brisk walk. This was performed for a total of 12 days, six days for each condition, over a three week period. Affective responses were measured using the short form of the Activation Deactivation - Adjective Checklist pre, 30, 60, and 120 minutes post each condition. The AD-ACL consists of four subscales including two for both positive (energy and calmness) and negative affect (tension and tiredness). Findings revealed the walking condition showed significantly higher increases in energy and lower scores for tiredness than the sugar snack. For the sugar snack condition, energy increased at first, but then decreased lower than pre test levels by 120 minutes post.

Additionally, tiredness scores decreased at first, but began increasing 60 and 120 minutes post for the walking condition. At each post-test assessment, tension scores were higher after the sugar snack and significantly lower after walking. Although decreased tension persisted for 120 minutes post walking, the tension scores were lowest at 30 and 60 minutes post walking. No significant results were found for calmness. This study was novel in its field by showing brisk walking not only decreased negative but also increased positive affect. The relationship between exercise and positive affect has since then been a topic of much interest and the research has developed to support this relationship.

To examine the effects of exercise on affective responses in a naturalistic setting, Gauvin, Rejeski, and Norris (1996) studied affective responses to acute vigorous physical activity in 52 middle aged females. An advantage of this study was that the exercise session occurred in the participants' natural environment. These women were instructed to participate in physical activity as normal and were given the Exercised-Induced Feeling Inventory (EFI) which assesses categorical affective states including positive engagement, tranquility, revitalization, and physical exhaustion. Participants were also given a questionnaire assessing positive and negative affect based on the dimensional view. They were instructed to complete both questionnaires pre and post each vigorous exercise session lasting 20 minutes or longer (such as fitness classes, sports activities, jogging, etc.). Data was collected for a total of six weeks and participants completed an average of three bouts of activity per week. Based on categorical affective responses, results showed that exercise produced significant increases in positive engagement, revitalization, and tranquility; however decreases in exhaustion did not reach

significance. The results also showed an increase in positive affect as well as a decrease in negative affect based on a dimensional affect conceptualization.

Bartholomew and Miller (2002) also observed increases in general positive affect as well as energy and calmness following exercise. They also observed decreases in negative affect as well as tension and tiredness in their study of 204 undergraduate females. Questionnaires assessing these affective feeling states were given to the participant's pre, five minutes post and 20 minutes after an aerobic exercise dance class.

Similar positive affective responses have also been observed following 10 minutes of laboratory treadmill walking (Hall, Ekkekakis, VanLanduyt, & Petruzzello, 2000). In this study, 42 college-aged males and females walked at a self-selected pace in a laboratory setting on two different occasions. Before, immediately post and 15 minutes post walking, participants filled out the Activation Deactivation Checklist (AD-ACL). Also, a short form of the State Trait Anxiety Inventory (STAI) assessing anxiety was used. Ratings of Perceived Exertion (RPE), heart rate, and walking speed data were collected after five and again after 10 minutes of walking. During the walk, participants wore an EEG (electroencephalography) cap to record bioelectrical signals to examine regional brain activity. Results revealed energetic arousal increased significantly from pre to post walking on both days, however no significant reductions in tense arousal or anxiety were observed. These findings highlight that increases in positive affect may be more prevalent in non-clinical populations than reductions in negative affect.

Similar positive affective responses were also observed in short bouts of outdoor and laboratory treadmill walking lasting from 10-15 minutes (Ekkekakis, Hall,

VanLanduyt, & Petruzzello, 2000). Increases in activation and feelings of pleasure were robust across the ecologically valid settings and across the four samples included in the study.

Mounting research continues to provide support that exercise not only decreases negative affect, but also increases positive affect. Since the relationship between exercise and affect is becoming better understood, it is important to advance the literature by investigating how to enhance positive affective responses to exercise. When positive affective responses are felt, individuals may view exercise more favorably thereby increasing the likelihood of exercise participation. Increasing positive affect is also important in using exercise as a tool to facilitate psychological well-being. Knowing what influences affective state responses will help accomplish these very goals.

Moderators Influencing Affective Responses to Exercise

Characteristics of an individual (e.g., age, gender) performing the exercise have been speculated by researchers to influence the nature and magnitude of psychological responses to exercise. One such potential moderator that has been studied in a small body of research is age. Many of the studies assessing affective responses include samples of college-aged males and females; however it is important to consider how older adults respond to exercise to ensure that affective responses are robust across the lifespan.

Focht, Knapp, Gavin, Raedeke, and Hickner (2007) examined this very issue by recruiting a sedentary sample of 18 young adult males and females (mean age= 24.10 years) and 15 older adult male and females (mean age= 64.20 years). These individuals participated in four 20 minute cycling sessions per week for eight weeks. Participants

exercised at an intensity of 65% of their VO_{2peak} as determined by a graded VO_{2peak} cycle ergometer test. Affective responses were measured pre, 10 minutes during, and immediately post the cycling session performed at the second session of the eight week trial. Affect was measured using the Exercise-Induced Feeling Inventory (EFI), Felt Arousal Scale (FAS) which measures the activation dimension, and the Feeling Scale (FS) which measures the valence (pleasant/unpleasant) dimension of affective responses. The overall findings were relatively surprising in that no significant increases were observed in feeling scale or positive engagement responses, but decreases in tranquility, and increases in physical exhaustion were observed from baseline to during and post exercise when collapsed across both age groups. The only differences between the age groups were higher FAS scores in the younger age group from baseline to during and post exercise. Also, significant decreases in revitalization in the older adult group were observed whereas the younger group did not show any change in revitalization. The older adults also reported slightly higher RPE than the young adults. Overall, the affective responses to exercise were very similar in both samples. Results were conflicting with the affective responses typically observed in exercise studies.

Other research examining older adults has produced slightly different results. Pierce and Pate (1994) observed improvements in psychological responses in a sample of older female adults (n = 16) ranging from 57-71 years old that were regularly active. Affective responses were measured pre and post an aerobic exercise dance class using the Profile of Mood States (POMS). The POMS consists of 65 adjectives reflecting six mood scales which are tension, depression, fatigue, vigor, anger, and confusion. Results showed

decreases in tension, depression, fatigue and increases in vigor were observed in this sample following exercise. With the conflicting results between studies, it is possible that while age may be a moderator, other moderators present in the study may have influenced the affective responses. For example, gender and activity levels may influence affective responses.

In one of the first studies to examine gender differences on affective response, Parftt, Markland, & Holmes (1994) compared active males (n = 20) and females (n = 20) to inactive males (n = 20) and females (n = 20). Affect was measured using the Feeling Scale (FS) during, post, and 5 minutes post exercise. Participants completed two brief exercise sessions lasting four minutes. One session consisted of working at 60% of their maximum workload and the other session at 90% of their maximum workload. Results revealed that active males and females, compared to the inactive groups, experienced significantly more positive affective responses in the 90% workload. However, no differences were found between gender or activity level for affective responses in the 60% workload. While most studies include a baseline measure of affect, this study did not. A baseline measure may have provided additional insight into differences, if any, between the males and females.

In another study examining the duration of exercise on affective responses in both males and females, Daley and Welch (2004) examined the affective responses of both groups to 15 and 30 minutes of cycling. When baseline data was collapsed across gender, no significant differences were found. Participants, regardless of gender, showed similar

trends for affective responses. The trend was for positive well-being scores to increase while simultaneously psychological distress and fatigue decreased.

Additionally, Ekkekakis, Hall, VanLanduyt, and Petruzzello (2000) examined affect responses to short bouts of outdoor and indoor treadmill walking sampling both male and female undergraduate students were recruited for a study including four experiments. Affective responses to the exercise were measured dimensionally and found to be similar within individuals and across the four samples. Participants reported higher activation, decreases in tension, and increases in calmness as well as pleasant affect. Gender was not found to moderate affective responses. Overall, gender has not emerged in literature to be a salient factor in affective state responses to exercise, although older adult males and females have yet to be compared.

Although affective responses are similar across age and gender, fitness level may moderate affective responses to exercise (Parfitt, Markland, & Holmes, 1994). Both active males and females reported increased positive affect assessed by the Feeling Scale whereas inactive males and females reported lower Feeling Scale scores during high intensity exercise. Further examination of fitness level can be found in a study by Boutcher and Landers (1988) in which trained and untrained males (n=30) participated by running on the treadmill for 20 minutes. Trained runners ran for about 80-85% of their max heart rate and the untrained runners ran at the same RPE of the trained runners. State anxiety was measured 13 and 5 minutes pre and 5 and 13 minutes post exercise. Significant reductions in state anxiety were observed only for the trained individuals whereas the non-trained group saw only slight decreases in anxiety.

In a more recent study, Boutcher, McAuley and Courneya (1999) found significant decreases in negative affect for untrained males. Affective responses to running in trained (n=13) and untrained males (n=14) were compared. Each participant completed a 30 minute treadmill running session consisting of a 10 minute light, 10 minute moderate, and 10 minute hard intensity. Speeds were adjusted using RPE and affective responses were measured with the FS and the Positive and Negative Affect Scale (PANAS) which measures positive (feelings of pleasantness) and negative (feelings of stress) affect. These scales were administered 5 and 10 minutes pre and 5 and 10 minutes post exercise as well as the 5 and 10 minute mark during each intensity. Significant increases in positive affect were observed in the trained group during the moderate and hard intensities and post exercise compared to baseline and compared to the untrained group. Negative affect was not significantly different for the trained group from baseline to during and post exercise; however the untrained group saw significant decreases from baseline to during and post exercise. Feeling Scale Responses were similar between the trained and untrained groups, however the untrained individuals consistently reported lower feeling scale ratings but this trend did not reach significance.

The previous FS findings were similar to those found in a study by Rudolph and McAuley (1998) where runners (n=13) and non-runners (n=13) responses to the FS during a 30 minute jog at 60% VO_2 max were compared. Feeling Scale responses were collected pre, during at minute 9, 19, 29, and post exercise at minute 10 and 30. Tukey post hoc analysis showed significantly lower FS responses by non-runners during exercise than runners. The findings of the four previous studies (Boutcher & Landers,

1988; Boutcher, McAuley, & Courneya, 1999; Parftt, Markland, & Holmes, 1994; Rudolph & McAuley, 1998) support that untrained individuals do not experience the same affective responses to exercise as trained individuals when performing the same exercise at the same relative intensity based on RPE. During high intensity exercise individuals that are regularly active experience enhanced positive affect and decreased state anxiety whereas inactive participants may feel decreases in positive affective states during high intensity exercise and in some instances feel increases in negative affect.

Another factor that may moderate affective responses is baseline affect. As previously discussed, Boutcher et al. (1999) also considered baseline affect levels in their study. Baseline levels are an important moderator because if the participants report high positive affect pre exercise levels, then positive affect may not have much room to improve from an exercise session. The same could be true if participants report high levels of negative affect at baseline then they have more room to improve.

Rejeski, Gauvin, Hobson, and Norris (1995) investigated baseline as well as in-task feelings and their impact on post exercise affect responses. A sample of 80 moderately fit young women were recruited and randomly assigned to one of four groups including a 10 minute attention control, 10 minutes, 25 minutes, and 40 minutes of exercise on a cycle ergometer. Affect was measured pre and 20 minutes post using the EFI and PANAS while the FS was administered during the last two minutes of the exercise conditions. Significant time main effects were found for tranquility, positive engagement, and revitalization. Only revitalization showed a significant treatment by time interaction. By further examination of the pre test scores the authors found for

revitalization that participants reporting a pretest score below four showed the largest gains in that subscale post exercise for revitalization. Feeling scale responses were robust for each exercise condition.

Breus & O'Connor reported similar findings in their sample of 18 moderately active high trait anxiety young adult females. The participants with the highest state anxiety scores as measured by the State Trait Anxiety Inventory (STAI) before exercise were the only group to have significant reductions in anxiety post exercise. In addition to an exercise condition, they also included a group that studied during exercise and another group that simply studied without exercising as well as a control condition where the participants sat quietly for 40 minutes on a cycle ergometer. The participants in those conditions did not show lower post condition anxiety scores. While the exercise did lower anxiety scores, the pre test scores for anxiety were highest for this condition. With higher pre test scores in the exercise condition, this may have allowed more room for improvement compared to the other conditions.

Additional clarification how baseline affect may potentially influence affective responses can be found in a study by Focht (2002). Young adult females that were physically active (n=19) completed three experimental conditions including a prescribed intensity for weight lifting, a self-selected intensity, and a quiet rest control. State anxiety responses as measured by the State Trait Anxiety Inventory (STAI) were collected pre, 5, 20, 60, and 120 minutes post each condition. Findings showed state anxiety levels decreased significantly below baseline levels at the 5, 20, 60, and 120 minute post exercise conditions for participants with high baseline anxiety scores. Significant

reductions in state anxiety were only found 60 and 120 minutes post exercise for those with a low baseline anxiety. Focht (2002) concludes that anxiety levels at baseline are an important indicator of the anxiolytic responses to acute exercise.

Stimulus Properties of Exercise and Affective Responses

The relationship between exercise and affect may be influenced by many variables. In addition to moderators, psychological responses to exercise are also influenced by the stimulus properties of exercise itself such as duration and intensity. While studies show exercise enhances positive and reduces negative affect, the next question is what dose of exercise is needed to improve affect determined by duration and intensity. Research has examined this issue.

Short brisk walks lasting 10 minutes have been found to significantly increase energy as well as decrease tension even up to two hours post exercise in a sample of undergraduate women (Thayer, 1987). Daley and Welch (2004) found similar results in their sample of regularly active young men (n=11) and women (n=12) who exercised on a cycle ergometer on two different days at two different durations. The two durations examined were longer than in Thayer's study, including 15 and 30 minutes of moderate intensity aerobic exercise on a cycle ergometer. Affective feeling states were measured using the Subjective Exercise Experience Scale (SEES) which measures three affective states including positive well-being, psychological distress, and fatigue. Responses to the SEES were collected pre exercise, midpoint, and post exercise (5 minutes, 30 minutes, 1 hour, and 2 hours post). For the post exercise assessments, participants were contacted by phone to get all, but the 5 minute post exercise assessment. The authors hypothesized that

30 minutes of exercise would result in stronger affective state responses during and post exercise. However, contrary to their hypothesis, no differences in psychological benefits between the two exercise durations were found. Both the 15 and 30 minutes of exercise produced significant increases in positive affect and decreases in negative affect and fatigue. More specifically, negative affect scores were similar at baseline and during exercise with decreases being observed post testing. Positive affective responses were significantly lower during exercise than 5 minutes post exercise and remained elevated 2 hours post exercise. The post testing times were a strength in this study due to the lack of research examining acute affective responses 2 hours post acute physical activity.

These results were in line with Rejeski et al. (1995) who also observed increases in positive affective state responses after 10, 25, and 40 minutes of exercise when post affective state responses were measured 20 minutes after the cessation of exercise. The findings of the previous studies support that exercise can produce affective responses in as little as 10 minutes of moderate exercise eliciting psychological benefits lasting up to 2 hours.

Exercise intensity of exercise has also been shown to influence affective state responses to exercise. Steptoe and Cox (1988) recruited 32 female students to participate in a single laboratory visit consisting of four consecutive 8-minute exercise intervals on a cycle ergometer. Participants exercised on a cycle ergometer a rate of 50 rpm against 25 Watts (low intensity) for two intervals and 100 Watts (high intensity) for the other two intervals. An adaptation of the Profile of Mood States (POMS) using only 6 items representing four subscales including tension/anxiety, fatigue, vigor, and

confusion/bewilderment was used. In addition, three items were added to measure exhilaration. The State-Trait Anxiety Inventory (STAI) was also administered to measure anxiety. Affective state responses were measured pre and post each interval. Both fit and unfit individuals experienced significant increases in tension/anxiety and decreases in vigor following the high intensity exercise intervals whereas low intensity increased feelings of vigor and exhilaration. This study suggested that lower intensity exercise improves affect more so than higher intensity exercise.

In more recent research, Hall, Ekkekakis, and Petruzzello (2002) report results that suggest high intensity exercise may improve post exercise affect, but may not be optimal in enhancing affect during exercise. The authors examined affective responses to increasing exercise intensity by having college-aged males (n=17) and females (n=13) perform a graded treadmill test to volitional fatigue. The Feeling Scale (FS) and Felt Arousal Scale (FAS) were administered pre, at each minute of exercise, immediately, 10 and 20 minutes post exercise. The Activation-Deactivation Checklist (AD-ACL) was administered pre and each post exercise measurement. After the a 3 minute warm up walking at 3 mph, participants started running at 5 mph at a grade of 0%. Every two minutes the intensity was increased by alternately increasing speed by 1 mph and grade by a 2% incline. This trend continued until the participants reached volitional fatigue. Immediate post exercise responses to the AD-ACL showed significant increases in energetic arousal and calmness compared to baseline. Significant decreases in tension arousal at the 10 and 20 minute post exercise responses were also observed. In the beginning of the exercise running protocol affective changes were due to increases in

arousal as measured by the FAS, however as the intensity continued to increase the FS responses progressively became more negative. The authors attribute the lower affective responses during exercise to the transition in the body to anaerobic metabolism necessary to sustain the vigorous exercise, also referred to as the ventilatory threshold (VT). Throughout the exercise protocol participants reported significantly lower FS and higher FAS scores as intensity increased. Post test results show significantly increased FS and immediate drops in FAS scores. The sample used in this study included young and active individuals. Consideration in whether the affect-intensity relationship holds true for older adults and unfit individuals warrants further investigation. However, the results of this study support that high intensity exercise can result in increased feelings of negative affect during exercise even if post exercise affect is positive.

Recently in a study with similar methods, Hall et al. 2002 investigated unfit women's (n=20) affective responses to a graded exercise session during and post exercise (Welch, Hulley, Ferguson, & Beauchamp, 2007). The participants were assessed on a cycle ergometer rather than a treadmill like in Hall et al. (2002) but affect was assessed via FS and FAS in the same way. Responses on the FAS and FS followed a similar pattern as observed by Hall et al. (2002) in which FS responses decreased and FAS responses increased during exercise. The differences between the affective experience of the unfit individuals in the present study and the fit individuals in the previous study are that the unfit individuals reported lower affective valance responses earlier in the exercise session. Also, FS scores did not improve immediately after exercise, but instead significantly improved at 10 and 20 minutes post exercise for unfit individuals. These

findings suggest that physically inactive individuals may need more recovery time before affective improvements from exercise can be seen.

To further their investigation of how exercise intensity influences affective responses, Ekkekakis, Hall, and Petruzzello (2008) had a sample of young adult men (n=16) and women (n=14) exercise at three different intensities: below ventilatory threshold (VT), at VT, and slightly greater than VT. The AD-ACL, FS and FAS questionnaires were administered every three minutes during the exercise session. Consistent in their previous work, significantly higher affective valence scores were reported immediately post exercise. However, affective valance responses were the lowest and arousal the highest when participants exercised above the ventilatory threshold. The two other conditions did not show significantly lower affective valence responses. Ekkekakis et al. conclude that FS responses decline when the intensity exceeds VT revealing that the dose response relationship of improved affect responses is not linear. The VT seems to serve as a "turning point" in which affective state responses are less positive.

Exercise intensity is an important influence on affective responses. Moderate exercise has shown to improve affect, while vigorous exercise above VT does not improve affect until after exercise. These positive increases can take longer than 5 minutes after exercise cessation for unfit individuals. Understanding how unfit individuals respond is important because what they experience during and post exercise may link acute to chronic exercise habits. Knowing the best strategies to increase positive and reduce negative affect feeling states from the exercise session will help fitness

professionals tailor the session to that individual. Prescribing the right duration and intensity is essential. An additional consideration that could influence participants' exercise experience and affective responses is whether exercise intensity is prescribed or self-selected.

In a study examining untrained and unfit individuals, Ekkekakis and Lind (2006) compared affective responses and RPE in a group of overweight (n=16) and normal-weight (n=9) women. Using a within-subject design, the participants performed two treadmill exercise sessions with the first consisting of a self-selected pace and the second being an imposed speed by the researchers, however the imposed speed was assessed to only be 10% faster than the self-selected pace. Every five minutes RPE and Feeling Scale (FS) responses were collected. Feeling Scale responses were similar in both groups for the self-selected pace, however the overweight group reported significantly lower feeling scale scores for the imposed speed exercise session. RPE and oxygen uptake was higher for the overweight group compared to the normal-weight group for both sessions. Results from this study raise questions about imposed versus self-selected intensity and also reveal that overweight women exercise at a higher percentage of their aerobic ability than normal weight counterparts. Ekkekakis and Lind (2006) suggest that it may be harder for overweight individuals to adopt an active lifestyle because they do not feel the increases in positive affect like normal weight individuals feel. Further, overweight and sedentary individuals may benefit from selecting their own pace at a prescribed activity which may possibly increase enjoyment as speculated by the authors.

Affective responses of regularly active individuals may not be as sensitive to prescribed versus self-selected workout intensity in resistance compared to aerobic exercise. For example, Focht (2002) examined anxiety responses to two weight lifting conditions of prescribed and self-selected intensity. Baseline measures were found to be a strong indicator of affective responses. When baseline anxiety responses were high, exercise reduced anxiety, but when the baseline level of anxiety was low there was little room for improvement and thus anxiety scores did not decrease substantially. Furthermore, prescribed versus self-selected intensity did not influence anxiety. However, Focht (2002) did not include a measure of positive affect which would provide more insights into affective responses between the conditions.

Parfitt, Markland, and Holmes (1994) showed that both regularly active males and females had similar significant increases in positive affect immediately and 5 minutes following high and moderate intensity exercise. Both active and inactive participants exercised on a cycle ergometer at 60% of their max workload and 90% of their max workload for two different exercise sessions. The active participants regardless of gender, reported significantly more positive affect, as measured by the Feeling Scale, immediately and 5 minutes post exercise for the high workload than the inactive participants. In comparison, responses were similar and more positive for all groups for the moderate intensity exercise session. Feeling scale responses were also more positive 5 minutes post compared to immediately post exercise for both exercise conditions. These findings contribute significantly to the understanding of affective responses post exercise. Improvements in affect following acute exercise have been substantially documented for

immediate to five minutes post exercise (Hall, et al., 2000; Perice & Pate, 1994; Parfitt et al., 1994; Boutcher et al., 1999, Rudolph & McAuley, 1998; Ekkekakis et al., 2008) and shown to last for 20-30 minutes (Rejeski et al., 1995; Gauvin et al., 1996; Bartholomew & Miller, 2002; Rudolph & McAuley, 1998, Hall et al., 2000).

In summary, the stimulus properties of exercise are an important consideration to elicit increases in positive and decreases in negative affect. Exercise duration for as little as 10 minutes improves affective feeling states. Intensity of exercise above ventilatory threshold decreases affective valence for overweight and unfit individuals during exercise. Allowing a less fit person to choose an intensity for a prescribed exercise results in improved affective valence, whereas fit individuals' psychological responses have shown to be similar for prescribed and self-selected intensities. While the stimulus properties influence affective responses, additional consideration should be made for inward perceptions of the individual as they also play a role in affect responses to exercise. Furthermore, how long affective responses to exercise last are still not well understood. Some research has found increases in positive and decreases in negative affect remain 60 and 120 minutes post exercise (Thayer 1987; Daley & Welch, 2004, Focht, 2002). However not much research has examined that issue and therefore studies assessing how long improved affect lasts following exercise warrants further investigation. While measuring at appropriate times to capture affective responses in important, additional consideration for the stimulus properties of the exercise itself and how that influences affective responses should be made.

Temporal Dynamics

One important consideration necessary in examining the influence of exercise on affective states is the specific times at which affect is assessed. Typically researchers have assessed affect before and after exercise. While these collection times are necessary to observe overall changes, it is important to take into account how affect states may change throughout the exercise session (Lox, Ginis and Petruzzello, 2006). This is especially critical because even though participants may feel better after exercise, they may also feel worse during exercise if the exercise itself is difficult. Without a pleasing affective feeling state experience during exercise, adherence could be threatened. Gauvin and Rejeski (1993) recommended researchers to measure affect during exercise since it can fluctuate throughout the exercise bout and only measuring pre and post affect does not capture the affect states felt during exercise.

To investigate this phenomenon, Rejeski, Gauvin, Hobson, and Norris (1995) recruited 80 college-aged females and randomized them to four different groups, one being a control and the other three groups exercised for different durations of 10, 25, and 40 minutes. In the final two minutes of exercise the participants were asked for responses to RPE and the Feeling Scale. After resting for 20 minutes at the cessation of exercise, the participants were administered the Exercised-induced Feeling Inventory (EFI) and the Positive Affect Negative Affect Scale (PANAS). The authors found that those who scored low to moderate revitalization scores at baseline had the greatest post exercise increases. Additionally, regression analysis revealed those reporting the highest FS responses also reported the highest revitalization responses post exercise. These findings

support that feelings experienced during exercise relate to understanding how exercise influences psychological responses.

Understanding affective responses during and following exercise is important because that information can be used to structure exercise sessions that provide individuals with a positive experience. Further understanding of the lasting effects of the exercise experience can provide additional information for promoting physical activity and insights for improved mental health. The ability to structure exercise to provide participants with an experience of improved affect during exercise and lasting effects of these improvements will potentially provide them with a more enjoyable experience. When individuals participate in an enjoyable exercise experience that may influence them to be more likely to exercise again in the future (Focht, 2009; Raedeke, Focht, & Scales, 2007).

Social Psychological Factors and Affect

In advancement of the exercise and affective state literature, researchers began to recognize that social psychological factors influenced affective responses. One aspect of the exercise session that began to receive considerable attention was the exercise environment. Where the exercise was performed (e.g., naturalistic versus labatory setting) began to be an interest among researchers. In one of the first studies to do so, McAuley, Mihalko, and Bane (1996) compared exercising in a laboratory to wherever the person normally exercised in a sample of undergraduate males and females (n=53). In the naturalistic setting, the most common activity was walking or jogging both outdoors and indoors, followed by stationary cycling and stair stepping. Anxiety was measured using

the 10 item short version of the State Anxiety Inventory (SAI) pre, 10 and 20 minutes during, and 15 minutes post exercise. Both groups saw a significant decrease in anxiety post exercise as well as similar stable anxiety scores throughout the 20 minute exercise session. The authors did include a session for participants to come to the lab and see the exercise equipment to ensure that the unfamiliar nature of the labatory setting did not influence affect by making the participants more uncomfortable.

An important strength in the study by McAuley et al. (1996) was they included an aerobic exercise session in the participants' natural environment. Further examination of the ecoglogical setting can be found in a study by Focht and Hausenblas (2001). In this study affective state responses in females with high social physique anxiety (SPA) (n=25) and low SPA (n=25) in a naturalistic fitness center setting were examined. Participants completed both a quiet rest condition in a room free of distractions lasting 20 minutes and a 20 minute exercise session at the student fitness center on different days. Affect was measured pre, post, and 30 minutes post using the STAI and the EFI. Both exercise and quiet rest resulted in significant increases in tranquility, revitalization, and reductions in anxiety for both high and low SPA groups. Decreases in tension, calmness, and increases in positive engagement were only observed in the exercise condition for both groups. Results show that both the high and low SPA participants reported similar affective improvements in both the exercise and control condition. The contribution to the literature this study provided is important because they examined both high and low SPA females' affective responses to exercise in a naturalistic setting compared to quiet rest.

In a recent study by Focht (2009) affective state responses, enjoyment, and future exercise intentions were compared in laboratory treadmill walking and walking outdoors. Active college females (n=35) walked for 10 minutes in each setting on different days. Affective responses were measured by the Feeling Scale, Felt-Arousal Scale, and the Exercise-Induced Feeling Inventory (EFI) before, during (minute 5), immediately after and 10 minutes after the walk. Repeated-measures ANOVA analyses reveal that walking in both environments produced improved affective responses evident by increases in feeling states and arousal. However, increases were significantly higher for outdoor walking. Based on EFI responses, both indoor and outdoor walking resulted in increased revitalization and positive engagement with the outdoor walking showing significantly higher increases compared to the indoor walking condition. However, the positive engagement responses returned to baseline 10 minutes post exercise for both conditions. Physical exhaustion decreased significantly for both walking conditions, but no significant changes in tranquility emerged.

Focht (2009) also found scores for enjoyment and future intention to walk were higher for the outdoor walking session compared to walking in a laboratory setting. In addition, enjoyment and future intentions were strongly correlated ($r = 0.77$, $p < 0.001$) further supporting enjoyment as a potentially important factor that influences future activity involvement. These findings are similar to those in a study by Ekkekakis, Hall, VanLanduyt, and Petruzzello (2000) where affective responses from walking indoors and outdoors was compared in a sample of undergraduate students. In two of four experiments, participants walked outdoors in a group setting at a self-selected pace for

10-12 minutes. For the two indoor laboratory walking experiments, participants walked on a treadmill at a self-selected pace for 15 minutes. Affect was measured dimensionally pre and post for outdoor walking. For one indoor walking trial affect was measured pre, post, and 15 minutes post. For the other lab session affect was measured pre, during at minute 8 and 15, post, and 10 minutes post walking. The short bouts of walking in both ecological settings resulted in significantly higher activation, decreases in tension, and increases in calmness and pleasant affect consistently across the four experiments. Exercise has shown to produce desirable affective state responses in both laboratory and natural settings, however Focht (2009) supports that the affective responses may be enhanced when outdoors versus indoors.

Not only has the ecological setting of the exercise environment been examined, but research has also revealed leader behavior to influence affective responses to exercise. Turner, Rejeski, and Brawley (1997) examined how bland leader behavior compared to socially enriched activity leader behavior influenced affective responses to the exercise session. The leader in the bland condition gave indistinct class feedback and focused on negative corrections and general instructions not specific to any one participant. In the socially enriched class the leader gave encouraging feedback, used the participants' names, and focused on positive comments. Participants were randomized to either the bland or socially enriched exercise class. Results showed that participants in the socially enriched class experienced significantly greater increases in positive affect than the bland group. Participants also enjoyed the socially enriched class more than the bland class.

In further study of leader behavior and its influence on affect, Raedeke, Focht, and Scales (2009) examined whether the instructor's leadership focus on health or appearance influenced affective responses to exercise in women with high social physique anxiety. In one class the instructor wore tight fitting athletic clothing and gave appearance-related remarks to the class throughout the exercise session. In the other class the same instructor wore looser fitting gym clothes and made health related comments. Affect was measured pre and post using the FS, FAS, and the EFI. Results showed that students in both conditions felt better and experienced improvements in affect post exercise. However, those in the health-oriented class reported greater increases in positive engagement, revitalization, and enjoyment and lower exhaustion after class. Additionally, participants in the health-oriented class reported higher intentions of joining a similar exercise class in the future. This study helps put into perspective how leader behavior in an exercise class influences affective responses.

Another environmental factor that may influence affective responses include factors that may make exercise more enjoyable such as the use of music. Steptoe and Cox (1988) had fit and unfit individuals exercise on a cycle ergometer for four 8-minute intervals. Two of the intervals consisted of high intensity with and without music, as well as two intervals of low intensity with and without music. The song participants listened to was a popular upbeat song typically heard in exercise classes. Music did not appear to impact affective responses based on pre to post changes in affect. A trend toward increases in exhilaration during the intervals with music emerged, however this trend did not reach statistical significance.

In contrast, some research results show an improved affect when music is included. Boutcher and Trenske (1990) further analyzed how music impacts affective responses by recruiting college aged females (n=24) to participate in three separate exercise sessions lasting about 40 minutes each. Each session consisted of a six minute light, followed by a six minute moderate, followed by a six minute heavy intensity period on the cycle ergometer. Each session was either a control, no music, or music session in which participants could bring in their own music to listen to during exercise. Affective responses, as measured by the FS, were significantly more positive in the music condition during moderate and heavy workloads. Brownley, McMurray, and Hackney (1995) had similar findings in their sample of untrained runners (n=8) who reported more positive affective responses, as measured by the FS, when they listened to fast music compared to slow or no music. However, the trained runners (n=8) reported similar affective responses to each condition. These studies would have benefited from using additional measures in their study to capture other affective response changes. The FS by itself only captures the affective global valence (pleasure-displeasure). Including an additional scale such as the FAS and the EFI would help gain better insights to how music influences affective activation and more specific categorical state responses to exercise. Overall, music does play a role in affective responses to exercise, especially for untrained individuals. When the music was chosen by participants the affective responses were significantly improved during moderate and heavy workloads compared to no music. When the music is chosen for the participants, music does not appear to influence affect responses. Additionally, for

less trained individuals, music may make exercise more enjoyable and help provide a pleasant distraction during exercise.

Although several studies have shown that social-environmental factors influence affective reponses to exercise, the underlying mechanisms or reasons why these factors are related to affective responses are not well understood. It is possible that social-environmental factors influence affective responses through their influence on potential mediators of affective responses including self-efficacy, distraction, and enjoyment. Also, listening to music may help provide a more pleasant atmosphere for exercise participants as well as being health focused as a fitness professional compared to focusing on appearance as the previous literature reveals (Boutcher and Trenske, 1990; Raedeke, Focht, & Scales, 2007). These are very important considerations that impact affective responses to exercise.

Self-Efficacy and Affective Responses

Understanding mediators that influence affective responses to exercise are necessary to correctly analyze the exercise experience and provide insights to improving the exercise session. Mediators are variables that impact the relationship between two other variables. An important underlying psychological mediator linked to affective responses to exercise is a persons' self-efficacy. Self-efficacy refers to one's beliefs of their own abilities to successfully perform a certain behavior (Bandura, 1977). The role of self-efficacy in an exercise and affective responses was examined by Bozoian, Rejeski, and McAuley (1994). In their study, a sample of 36 undergraduate females were classified having either high or low efficacy for exercise. Participants completed a 20

minute exercise session on a cycle ergometer at 70% of their max heart rate (MHR). Participants filled out the Exercised-Induced Feeling Inventory (EFI) pre, during (minute 15), and 10 minutes post exercise. The high efficacy females showed increases in positive engagement and revitalization post exercise and maintained pre exercise levels of revitalization during exercise. In contrast, the low efficacy females experienced significantly lower levels of revitalization during exercise, but returned to baseline levels post exercise. Significant decreases in positive engagement were seen pre, during and post in the lower efficacy group. Both groups reported similar trends for tranquility and fatigue pre, during and post exercise.

Similar findings emerged when Bartholomew and Miller (2002) looked at how 204 undergraduate females felt about their performance after an aerobic exercise class and how that related to the psychological benefits they reported. Participants rated their exercise performance on a 1-item 5 point Likert-type scale with 1 = very poor and 5 = very well. Regardless of perceived performance, participants reported similar decreases in negative affect, tiredness, and tension. In contrast, those rating higher performance (scores ≥ 4) scored significantly higher 5 and 20 minutes post exercise positive affect and energy ratings compared to the low performance groups. Thus, self-efficacy is critical to understanding changes in positive affective states and less critical to understanding changes in negative states.

To further examine the relationship between self-efficacy and affective responses to exercise, Mihalko, McAuley, and Bane (1996) recruited middle aged males (n=47) and females (n=47). Self-efficacy for biking, walking, and jogging as well as affective states

were measured before and after a graded cycle ergometer exercise test. Affective responses included significant increases in positive affect. Additionally, those who rated high positive pre test affect scores also reported high post test scores. More importantly, this study reveals all participants reported significant increases in self efficacy for cycling and walking. In addition, the increases in self-efficacy, in part, mediated the increases in positive well-being ($R^2 = 0.13$, $p < 0.005$). These results support that self-efficacy perceptions can increase from an acute bout of exercise and improved self-efficacy is associated with improved affect.

Cumulatively, results from these studies reveal that self-efficacy mediates positive affective psychological responses to exercise with less influence on negative affect responses. If exercise can raise efficacy by providing an experience where individuals successfully accomplish the activity (mastery experience), then affect will improve. However, if participants do not feel successful then affect will most likely not improve. Self-efficacy is an important consideration when structuring an exercise session for a beginner. In addition, another important explanation for improved affect from exercise is the distraction hypothesis.

Distraction Hypothesis

The distraction hypothesis was developed by Bahrke and Morgan (1978). The researchers originally designed their study to examine the anxiolysis properties of noncultic meditation and acute physical activity, two types of seemingly contradictory therapies proposed to reduce anxiety. Participants included regularly active adult males (n=75) that were randomized to either a 20 minute treadmill brisk walk, a meditation

group using Relaxation Response therapy group, or a control group that sat quietly in a recliner for 20 minutes. Anxiety was measured pre, post and 10 minutes post each condition. The researchers hypothesized that anxiety would decrease in both treatment groups, but not in the control group. Contrary to their hypothesis, anxiety was significantly reduced in all groups for individuals with normal or high anxiety scores at baseline. These findings served as the foundation for the distraction or time out hypothesis. This theory contends that a time out or distraction from daily worries provides improvements in affect. Therefore, exercise improves affect because exercise provides a time out and distraction from daily life stresses. Bahrke and Morgan (1978) sparked a new interest in exercise psychology research and further investigation of this phenomenon has been the subject of recent studies.

In comparison, Focht and Hausenblas (2001) did find reductions in anxiety similar to Barhke and Morgan (1978). In this study, exercise in a naturalistic setting was compared to quiet rest. Affect was measured pre, 5 minutes post, and 30 minutes post exercise. In both conditions, improvements in anxiety and tranquility were observed 5 minutes post exercise and sustained for 30 minutes post exercise. However, only increases in positive engagement and revitalization emerged following exercise.

When a distraction does not provide a time out from daily worries and stresses then affect should not improve according to the distraction hypothesis. Support for this assertion has been found in a study by Breus and O'Connor (1998). In this study a sample of high trait anxious college-aged females (n=18) were recruited. Each participant completed four sessions including exercise only for 20 minutes, exercise and studying for

40 minutes, study only for 40 minutes, and a control condition. Exercise was completed at a low intensity (40% of VO_2 max) performed on a cycle ergometer. In the study conditions, participants were given a quiz at the end of the session. The quiz served as a manipulation check to ensure the participants were reading when they were supposed to. The researchers were able to give a quiz because all the participants were recruited from the same psychology class and were to read the same textbook for the study. Anxiety was measured pre and post each condition. Results showed that anxiety was reduced in the exercise only condition. The study conditions did not see a decrease in anxiety supporting the distraction hypothesis because the participants were not given a break from daily stresses. While no decreases in anxiety were reported in the quiet control group, which is inconsistent with the premise of the distraction hypothesis, it is important to note that participants were to sit on the cycle ergometer for 40 minutes. Therefore, the lack of change in affective responses could be due to sitting uncomfortably for that length of time.

Russell and his colleagues (2003) further studied the distraction hypothesis by examining how a distraction during exercise influenced affective responses. Instead of a study distraction, the content included an exercise reading material on health and exercise and a health video. A sample of male (n=32) and female (n=21) young adults were randomized to three conditions including (a) exercise and watching a health video condition, (b) exercise and reading health material, and (c) an exercise control with no distraction. All groups exercised for 25 minutes on a cycle ergometer and filled out the Profile of Mood States (POMS) pre and post exercise. Decreases in tension and

depression as well as increases in vigor were observed in each group. The results did not completely match the hypothesis because the authors expected the two groups with a distraction activity to show enhanced mood improvements compared to the control group, however improvements in mood were similar in all three group. Russell et al. (2003) propose that it may not be the distraction alone, but the enjoyment of the distraction that is also important to achieving mood enhancing benefits. If the distraction had been an enjoyable and self-selected distraction then the hypothesized results may have occurred. Rather than having the distraction activity chosen for them, like the health video and book in this study, allowing the participants to choose their own distraction such as DVD or book they like to read may provide a more enjoyable distraction. Additionally, only the POMS was used in this study which focuses on negative affective states. Research has shown that increases in positive affect are more strongly influenced by environmental factors compared to negative affective states and utilizing a measure that captures positive affective responses would provide a better understanding of affective responses.

Russell, et al. (2003) suggests the distraction needs to be enjoyable since the material in their study may have not been enjoyable for their participants. For example, Boutcher and Trenske (1990) showed those that brought in a cassette of their music to listen to while performing the exercise showed increases in their affective state responses. It is plausible that since the music was an enjoyable distraction, it gave the participants a break from their daily stresses and worries.

While research has supported the distraction hypothesis, McAuley, Mihalko, and Bane (1996) failed to support it. Undergraduate moderately active males (n=34) and

females (n=18) participated in three exercise sessions including a laboratory moderate to vigorous 20 minute session, a 20 minute exercise session in the environment of their choice, and a sitting quietly for 40 minutes control condition. Negative affect was measured using the 10-item short form of the State-Trait Anxiety Inventory pre, 10 minutes during, 20 minutes during, and 15 minutes post exercise and pre, 15, 25, 40 minutes during, and 15 minutes post control condition. Both lab and natural environment exercise produced significant decreases in anxiety post, but not during, exercise. In contrast, the control group saw little fluctuation in anxiety scores. However, the control condition sat for 40 minutes which is 20 minutes longer than the other two groups. Additionally, anxiety is important to measure, however the investigators did not assess positive affective state responses which are influenced by environmental factors. Regardless, the results did not reveal affective improvements in the control condition in which individuals were given a time out from their daily worries which is inconsistent with the distraction hypothesis.

The distraction hypothesis serves to explain why exercise improves affect. This hypothesis has been supported in literature to be a viable explanation for the improvements in affect from exercise (Bahrke & Morgan, 1978; Breus & O'Connor, 1998; Focht & Hausenblas, 2001; Russell et al., 2003). However, some missing links need to be addressed in future research. As previously mentioned, measures evaluating positive affect changes pre, during, and post exercise are needed. Russell et al. (2003) and Breus and O'Connor (1998) evaluated distraction activities and how they influence affective responses, however no enjoyment measure was used so the question remains of

how an enjoyable distraction compares to a less enjoyable one. Enjoyment is an important consideration as it may influence the affective responses to different exercise conditions. Further examination of the distraction and enjoyment relationship and how that impacts affective state responses is needed. In conclusion, support for the distraction hypothesis exists. Theoretically, based on the literature on the distraction hypothesis, including a distraction during exercise that is not related to ones worries and stresses may produce improvements in affective responses, however a distraction during exercise that is related to one's life stress may not provide the same improvements.

Enjoyment and Affective Responses

Enjoyment is defined as a positive response to the movement experience that reflects feelings such as pleasure, liking, and fun derived from the activity (Scanlan & Simmons, 1992). Research has begun to recognize and examine enjoyment as an important mediator that influences affective responses to an exercise session. An earlier study by Motl, Berger, and Leuschen (2000) examined enjoyment and its impact on mood. A sample of college students were recruited and randomly assigned to one of two classes. The two classes examined in this study included a rock-climbing class and a health education class where students watched a rock-climbing video and listened to a corresponding lecture. Results showed that students who enjoyed the class felt positive mood changes as measured by the Profile of Mood States (POMS). These researchers also found that enjoyment mediated the class differences in the POMS scores.

Further examination and clarification of the relationship between enjoyment on exercise and affective responses can be found in a study by Raedeke (2007). The study

was composed of two experiments. In each experiment affect was measured pre and post an exercise fitness class. Enjoyment was measured post exercise. In the first experiment, Raedeke (2007) used a categorical measure and in the second experiment a dimensional measure of affect was used. Results showed enjoyment to be related to increases in energetic arousal and vigor post exercise. Findings also showed that enjoyment did not relate to decreases in negative affect.

Raedeke, Focht, and Scales (2007) investigated enjoyment and psychological responses to acute exercise with a sample consisting of 99 highly anxious college-aged females pre and post fitness classes. Reported findings included that enjoyment, as measured by an eight item short version of the Physical Activity Enjoyment Scale (PACES), correlated with increases in the participants' intentions of exercising in that same venue in the future ($r = 0.73$). In further examination of their results, Radeke et al. (2009) assert that enjoyment was also a mediator in revitalization and exhaustion as well as a partial mediator for other feeling states. Furthermore, enjoyment was stated to be an independent predictor for the activation dimension of affect.

Not only does enjoyment impact affective responses, it is also related to exercise involvement. Glaros and Janelle (2001) examined undergraduate students in an eight week exercise program designed to evaluate how varying workouts impacted exercise adherence. Individuals that were not regularly active were recruited and randomly assigned to one of three groups: variable, static, and preferred exercise. Participants were to exercise three times per week, but only cardiovascular exercise was prescribed and examined. The variable group changed their mode of cardiovascular exercise each week,

while the static group was instructed to use the same mode over the eight weeks. For the preferred mode the participants could choose the mode of cardiovascular exercise each session. Participants completed the short version of the Physical Activity Enjoyment Scale (PACES) which measures enjoyment, at the end of each exercise session. Results showed the variable group achieved the highest scores for enjoyment. In addition, the variable exercise group followed the exercise protocol the best of all three groups. These findings support that varying the exercise mode increased exercise adherence. Since the participants in this study were not regularly active the importance of enjoyment may have been critical to increasing the adherence during the eight week program.

In a longitudinal study, Titze, Stonegger, and Owen (2005) sought to further understand determinants that influence physical activity habits. To do this, questionnaires were handed out to middle-aged women involved with running events. Two years later they handed out the questionnaires again to the same participants (n=509) to examine the factors predicting adherence to running. In the absence of family support, women that enjoyed running were eight times more likely to continue it than other women that did not have family support and did not enjoy running. In addition, enjoyment was one of the highest rated reasons the women continued running in conjunction with 'being out in nature' and 'feeling better afterwards'. This study supports the notion that enjoyment is of high importance when adopting and adhering to physical activity. Henderson and Ainsworth (2002) also supported this idea in their qualitative study involving women of minority that are $\geq$ 40 years old (n=26). Each participant was extensively interviewed on the subject of physical activity. An emerging theme surfaced supporting that these

women participated in physical activity if it was intrinsically enjoyable to them. Women that thought of physical activity as unpleasant did not participate in any exercise. The authors found that focusing on intrinsic enjoyment is key in understanding how to help inactive adults start being and remain active.

Strong evidence suggests enjoyment to be an important link between acute and chronic exercise. Research has shown exercise to mediate improvements in positive affective responses from exercise. Integrating enjoyment with the distraction hypothesis suggests that enjoyable exercise may provide a greater distraction from life stress and thus more positive affective responses compared to less enjoyable exercise. Enhancing feeling states resultant of a single exercise session could lead to repeated exercise and ultimately an active lifestyle. In addition, enhanced feeling states during exercise may be the key to improving psychological well-being through exercise.

Physiological mechanisms

In addition to the self-efficacy, distraction and enjoyment explanations, physiologically based hypotheses have been developed over the years explaining why exercise may improve affect. Research has accumulated in attempt to explaining these physiological processes. One such theory is the endorphin hypothesis which poses that certain endorphins are emitted in response to exercise that is of high intensity weight training or aerobic exercise (Landers & Arent, 2007). Although the data is conflicting, proponents of this theory believe endorphins play a role in the reduction of anxiety as well as increases in positive affect responses to exercise.

In addition to the endorphin hypothesis, the norepinephrine hypothesis suggests that physical activity can help synthesize norepinephrine in the brain. Exercise is theorized to amend the monoaminergic and noradrenergic pathways similar to functions of antidepressant drugs (Landers & Arent, 2007). In comparison, the serotonin hypothesis proposes that both acute and chronic exercise fosters greater levels of serotonin in the body. With increases in serotonin exercisers will have better sleep as well as feel less depressed during the day (Landers & Arent, 2007). Whereas the hypothalamic-pituitary-adrenal (HPA) axis hypothesis, explains that lower levels of depression and anxiety from exercise results because of augmented functioning of the HPA axis which enhances the regulation of the corticotrophin-releasing hormone (CRH) (Landers & Arent, 2007). Another physiological explanation theorized by some researchers is found in the endocannabinoid hypothesis. Calming responses from vigorous exercise can potentially be explained by the increase of anandamide which is produced during exercise, crosses the blood brain barrier and binding to cannabinoid system receptors in the area of the brain that affects cognitions, motor functions, as well as emotions (Landers & Arent, 2007).

The physiological processes suspected to be in part responsible for the decreases in negative affect and increases in positive still need further investigation. However, the cumulated research thus far seems promising. It is entirely possible that affective responses to exercise may be influenced by both physiological as well as social-environmental factors.

Conclusion

In conclusion, much remains to be known about the relationship between properties of the exercise experience and affective states. Individual characteristics may moderate the execise-affective response relationship (e.g., baseline level of affect, fitness level; Boutcher & Landers, 1988; Rejeski, et al., 1995 respectively). In addition, affective responses are influenced by both the stimulus properties of exercise itself (e.g., duration, intensity) as well as features of the social-psychological environment (leadership style, music). Some reasons why social-environmental factors influence affective responses may due to their influence on self-efficacy, the extent to which exercise provides a distraction, and enjoyment. Research has shown that exercise enjoyment enhances positive affect. Therefore, if a distraction used during exercise results in higher enjoyment, this may provide a greater distraction from life stress and thus result in more positive affective responses.

More information is needed to clarify the relationship between exercise distractions and enjoyment of the distraction. Russell, et al. (2003) used health related reading/video materials to provide to provide a distraction from life stress while exercising. However enjoyment of the distraction was not measured so the participants may or may not have enjoyed the provided materials. Breus and O'Connor (1998) only examined school related study material in a sample of high anxious females during low intensity exercise. However, this type of reading material may not have been enjoyable and may not have provided a distraction from life stress. Reading for pleasure may provide a greater distraction from life stress than reading school related material. The

purpose of the present study is to examine both pleasant and school reading during exercise and its impact on affective state responses during, 5 minutes post, and 60 minutes post exercise. In addition, an enjoyment measure was used to assess enjoyment in both reading groups. The results of this study will hopefully provide greater understanding of the distraction, enjoyment, and affective response relationship which is beneficial in activity promotion efforts and using exercise as a tool to enhance well-being.

CHAPTER 3: METHODS

Participants

In the present study, a sample of 36 college-aged male and female students were recruited from various Lifetime Physical Activity and Fitness classes at East Carolina University (ECU). This class is required of all students enrolled at ECU as part of general education requirements. A brief presentation of the study was made to the students explaining the study aim to evaluate mood responses to reading for pleasure versus school textbooks during exercise. Regularly active students were invited to participate. Students were excluded if they were unable to read during exercise. Also, students with health issues that would inhibit them from exercise participation were excluded from study participation. Participants received a pedometer for participating in the study. Data was collected near final examinations time period in the semester. This time period was chosen since students would be getting ready for finals and that would be a life stress for them. Therefore, exercise while reading a textbook would not provide participants a time out from their life stress.

Study Design

Participants exercised in a laboratory setting on two separate occasions within a 10 day period. On one occasion they read for pleasure and on the other occasion they read school related material during exercise. The condition order was randomly assigned and counterbalanced. Affect was assessed pre, post, and 60 minutes post exercise. Also, a short measure of affect was assessed at midpoint during exercise.

Procedures

Participants came to the Activity Promotion Lab for two separate exercise sessions. During the first session they completed the Par-Q and the Leisure Time Exercise Questionnaire (LTEQ). These questionnaires were administered to obtain information about the participants' activity level to ensure they were regularly active and did not have medical contraindications to exercise. The students were eligible for the study if they circle "No" to each question on the Par Q and if they met the activity guidelines of the American College of Sports Medicine (ACSM)/American Heart Association (AHA) (Haskell et al., 2007). If the participants met the inclusion criteria, they read and signed an informed consent document approved by the University Institutional Review Board prior to their involvement in the study. Basic demographic information was recorded such as age, race, gender, and year in school. Participants were asked about the types of exercise they currently participate in, if they typically read during exercise, and if so, what exactly they read. Height and weight were assessed using a Tanita scale and stadiometer to calculate body mass index (BMI).

Following height and weight measures, participants completed questionnaires assessing pre-exercise affect including the Feeling Scale (FS), Felt Arousal Scale (FAS), the Exercise-Induced Feeling Inventory (EFI), and the Stress/Arousal adjective Checklist (SACL). Once the questionnaires were complete, participants were instructed on exercising at a moderate intensity which corresponds to a heart rate between 50% and 70% of their age-predicted max heart rate (Centers for Disease Control, 2009) and were familiarized with heart rate monitors. The first 5 minutes of the exercise session included

a warm-up on the equipment of their choice at a low to moderate intensity. Participants could choose to exercise on an elliptical, treadmill, or cycle ergometer. After 5 minutes the intensity was increased to a self-selected moderate intensity and participants were reminded of the target heart range specific to their age. Participants were instructed to glance at the heart rate monitor periodically to ensure they were exercising in the targeted range. Heart rate was recorded at minute 15 and 30. The monitor was positioned so that the researcher could see the heart rate and record it without interrupting the participant. Prior research has shown that as the intensity increases, individuals will focus internally and pay greater attention to the body functions and feedback during exercise (Schomer, 1986). Therefore a moderate, rather than vigorous intensity, allowed them to be comfortable reading and exercising simultaneously.

At minute 15, participants were given the Feeling Scale, Felt Arousal Scale, and the RPE scale. At the conclusion of the 30 minute session, students stopped reading and performed a 5 minute cool down at their own low self-selected intensity. Participants were also given the option to stretch or walk and get a drink of water as part of the cool down. At the conclusion of the cool down the participants filled out the FS, FAS, EFI, and SACL questionnaires again as well as a Physical Activity Enjoyment Scale (PACES).

Participants were also given a questionnaire as part of a manipulation check to ensure they were reading when they were supposed to and to assess the extent to which the exercise session was engaging. The measure developed as a manipulation check evaluated attention in three dimensions including distraction, absorption, and focus

during the exercise session. On a 1 to 5 scale (1 = Not at all, 5 = Very much so) participants rated statements such as “The book I read was engaging” for the absorption subscale, “I forgot about the stresses of life” for the distraction subscale, and “To what extent did you comprehend the reading material?” for the focus subscale. If the reading during exercise provided a distraction then participants should report higher engagement on all three dimensions.

After they completed the questionnaires, a second appointment was scheduled. Participants were instructed to check their email once they returned to their room or apartment, as they were emailed a link to the 60 minute post exercise questionnaires (FS, FAS, EFI, and SACL). Affective state responses to exercise are transient and gradually return to baseline (Lox, Ginis, & Petruzzello, 2006). However, most studies only examine affect immediately post exercise. Measuring affect 60 minutes post exercise will provide additional insight into the duration of affective responses.

At the second exercise session the same protocol was followed, only the participants read material opposite of what they read at the first session. The exercise equipment and settings were recorded at the first session, so at the second session participants completed the same type of exercise performed in the first session and using the same settings as the first session. It is important to note that participants were not allowed to listen to music as that could have influence affective responses independently of the reading material.

Reading Material

Participants in this study were asked to bring in material they read for pleasure for one session, and for the other session they were to bring a class related textbook. Pleasure reading material referred to any book or novel participants read for fun. Any reading material emphasizing physique or appearance was excluded for the study as that may promote increased negative feelings about oneself. The less pleasant reading material included class related textbooks excluding health and fitness class material. If the participants did not have specific books they read for pleasure, reading material was provided to them. For pleasure reading material, several Chicken Soup for the Soul books were available to choose from. In addition a Calvin and Hobbes book was available. However, the majority of participants brought their own pleasure reading. Magazines were excluded for this study as many magazines include pictures and articles focused on health and physique which could have increased negative feelings about oneself. Additionally, magazines most likely would not have provided the reader with continuous reading material as articles are short in magazines and the exercise session lasted for 30 minutes. Additionally, people tend to flip through magazines versus focused reading, which would not be ideal for the absorption measurement component of the study.

Measures

Within exercise psychology, a variety of approaches have been used to assess affect. Some researchers suggest that affective states can be parsimoniously described by underlying dimensions (Lox, Ginis, & Petruzzello, 2006). Others have assessed more specific categorical affective states such as anxiety, engagement, boredom, revitalization,

and vigor. However, Tellegen, Watson, and Clark (1999), explain that affective responses are hierarchically structured and affective states can be described by both higher-order dimensions as well as lower-order specific categorical affective states.

Based on a circumplex model of affect, Tellegan et al. (1999) suggest the global higher order levels consist of basic hedonic tone (pleasant to unpleasant) and activation (low to high arousal) dimensions of affect. Based on the combination of affective valence and activation dimensions, affective states range from pleasant-activated feelings (e.g., vigor) to unpleasant-unactivated feelings (e.g., tiredness) as well as from unpleasant-activated (e.g., anxiety) to pleasant-unactivated feelings (e.g., calmness) (Lox, Ginis and Petruzzello, 2006). Lower-level affect changes refer to specific and distinct categorical affective states such as revitalization or tranquility. For this study, both dimensional and categorical measures of affect were used. In order to measure affect changes categorically the EFI was used. To measure affect changes in the dimensional approach the FS, FAS, and SACL was used.

Feeling Scale (FS)

To assess the basic hedonic tone (pleasure/displeasure) affect dimension, participants completed the Feeling Scale (Hardy & Rejeski, 1989) before, during and after exercise. This 11 point scale requires an individual to choose a number ranging from -5 (very bad) to +5 (very good) with 0 representing neutral feelings according to how the person feels at that moment in time (Lox, Ginis, & Petruzzello, 2006). This scale is commonly used in research examining affective responses to execise (Focht, 2009; Raedeke, Focht, & Scales, 2006).

In effort to evaluate the psychometric properties of this measure, Hardy and Rejeski (1989) performed three experiments in initial scale development efforts. The first experiment sampled 134 undergraduate students involving 68 females and 66 males who completed the Multiple Affective Adjective Check List (MAACL-R). This inventory includes a list of 132 adjectives that describe feelings. Students were instructed to identify which ones they felt during exercise. The participants were divided into two groups so half of the sample focused on identifying negative feelings they felt during exercise, and the other half focused on the positive feelings they experienced. The top ten positive feelings reported were adjectives such as active, energetic, healthy, and enthusiastic. Some of the top ten negative adjectives identified were irritated, miserable, disgusted, and displeased. Since the feeling scale ranges from very bad to very good it is important that individuals are able to distinguish between good and bad feelings. Results indicated that the participants could identify good (alive, fit, etc.) and bad (discouraged, annoyed, etc.) feelings with a classification matrix accuracy of 95.52%.

In experiments two and three completed by Hardy and Rejeski (1989) the relation between the FS and RPE (ratings of perceived exertion) (Borg, 1985) were examined. In the second experiment, Hardy and Rejeski developed and administered a questionnaire in addition to the FS and RPE which were all used to assess physical activity habits, perceptions of exercise intensity, and affect at various intensities. Participants included 68 active undergraduate students. Findings revealed that the FS and RPE and have a correlation of -0.56 reflecting that the FS and RPE are related, but distinct constructs. These results were then supported in the third experiment by assessing the FS and RPE

ratings before, during and after cycling at 30, 60, and 90% of their maximum aerobic capacity as determined by a submaximal Astrand-Rhyming cycle test. Feeling scale responses and RPE were inversely moderately correlated for the 30% workload (r = -0.33), 60% workload (r = -0.45), and were strongly inversely correlated at the 90% workload (r = -0.55). Results support that what a person feels in terms of intensity and how a person feels in terms of pleasure are two different things. These findings provided additional support of the FS's construct validity established in the first experiment.

Felt Arousal Scale (FAS)

The Felt Arousal Scale (Svebak & Murgatroyd, 1985) was also used to measure the activation or arousal affect dimension. Participants chose a number from 1 (low arousal) to 6 (high arousal) according to their level of arousal they feel at that moment. Research findings support this scale as a valid measure of arousal (Ekkekakis et al., 2008; Focht et al., 2007; Hall et al., 2002). In initial scale development efforts, college-aged students performed a race simulation video game and then rated their arousal level on the FAS (Svebak & Murgatroyd, 1985). The participants were then interviewed to ascertain their arousal level. Arousal level assessments based on the interview results and FAS responses were similar.

Stress/Arousal Adjective Checklist (SACL)

This measure is an adapted scale of Thayer's (1986) Activation/Deactivation Adjective Checklist (AD-ACL). Some adjectives were modified to represent terms that would be more readily recognized by respondents (MacKay, Cox, Burrows, & Lazzerini, 1978). Further validity was established in a study by King, Burrows, and Stanley (1983)

where the SACL was administered to different populations after a stress inducing task. The results confirm the ability of the SACL to discriminate between the positive and negative responses the participants felt in response to stress and arousal. The SACL measures affect according to the dimensional approach. According to the circumplex model of affect, the model creates four quadrants. Affective responses will fall in one of the four quadrants, according to dimensional view of affective responses. These quadrants include: a) pleasant high activation, b) pleasant low activation, c) unpleasant low activation, and d) unpleasant high activation. The SACL measures affective responses in each of these quadrants. The subscales for the SACL that represent the four quadrants include tension (negative feelings and high activation), energy (positive feelings and high activation), calmness (positive feelings and low activation), and tiredness (negative feelings and low activation). For this measure the participants rated on a 5 point Likert type scale a list of 20 adjectives that correspond with the dimensional affective states that can alter with exercise.

Exercise-Induced Feeling Inventory (EFI)

The Exercise-Induced Feeling Inventory (Gauvin & Rejeski, 1993) is a brief categorical affective state questionnaire. This scale has shown to be an accurate measure of feeling states that are exercise-induced. The EFI was developed by Gauvin and Rejeski (1993) to provide insight into how feeling states are affected by acute bouts of exercise. A total of 12 terms representing the four subscales are listed and participants choose a number on a 5-point scale ranging from 0 (do not feel) and 4 (feel very strongly) based on their current feelings. These four feeling states consist of positive engagement,

revitalization, tranquility, and physical exhaustion. This questionnaire was developed by narrowing down the abundance of words that describe feelings during exercise to 12 terms that specifically describe one of the four feeling states felt during exercise.

In the first of five experiments, Gauvin and Rejeski (1993) asked experts in exercise psychology as well as regularly active students to narrow down a list of terms that was formulated by current popular tools such as the Activation/Deactivation Adjective Check List (Thayer, 1986). Researchers and students identified the relevance of each term in representing affect responses by an acute bout of exercise. The results were similar in both groups so that of 500 terms, 145 terms were kept for further analysis. The remaining 145 terms were grouped into similar categories and narrowed down by examining linguistic redundancy, and by addressing concerns that raised doubts about the face validity of some items. Four feeling states emerged as the prominent domains felt during exercise that adequately represented the remaining items which included positive engagement, revitalization, tranquility, and physical exhaustion. For each domain three terms were included on the final EFI scale.

In the next two studies, Gauvin and Rejeski (1993) explored the factor structure and evaluated the internal consistency of the scale. Participants included college-aged male and females that filled out the questionnaire before exercise in study 2 and after exercise in study 3. Physical exhaustion and tranquility were found to represent distinct feelings states, however some cross loading was found between positive engagement and revitalization. Internal consistency was investigated by computing Cronbach alphas for study two and three. For revitalization the values were .87 and .78 respectively, .82 and

.72 for tranquility, .82 and .74 for positive engagement, as well as .91 and .80 for physical exhaustion. Pre exercise internal consistencies were shown to be slightly higher than post exercise values.

The fourth study looked at how the EFI compared with the Positive Affect Negative Affect Scale (PANAS) and the Activation Deactivation Adjective Checklist (AD-ACL) which are two scales also measuring affect. The subscales of the EFI were hypothesized to correlate with the corresponding subscales of the other surveys. The highest correlations included the positive engagement and revitalization subscale of the EFI and the positive affect subscale of the PANAS showing a correlation of $r=0.69$ and $r=0.58$ ($p< .001$) respectively. In addition, the revitalization subscale of the EFI and the energy subscale of the AD-ACL showed a correlation of $r=0.47$ ($p< .001$). The physical exhaustion subscale of the EFI and the tiredness subscale of the AD-ACL had a correlation of $r=0.44$ ($p< .001$). Additionally, the tranquility subscale of the EFI and the positive affect subscale of the PANAS correlated at $r=0.40$ ($p< .001$). The data from this experiment support the notion that the EFI has concurrent and discriminant validity.

In effort to evaluate construct validity the authors performed an additional study to ensure the EFI reflects feeling state changes that result from exercise. Forty participants took the EFI before, during and after exercising on a cycle ergometer in a lab for 25 minutes (n=20) or 40 minutes (n=20) at 70% of their heart rate reserve. Results from this experiment were compared to the results from experiment three where EFI responses were collected pre and post a group exercise class. Post test EFI responses of each experiment were compared because Hardy and Rejeski wanted to evaluate if the EFI

could discriminate between affective responses felt in a lab exercise session versus a group exercise class. The authors hypothesized that affective responses would differ between the two exercise sessions with greater positive engagement and revitalization felt in the group exercise class compared to the isolated lab session. Findings support that greater positive engagement and revitalization were felt by participants post the group exercise class. Post exercise tranquility and physical exhaustion scores were similar for both groups.

Overall, Gauvin and Rejeski developed this brief scale and acquired data supporting the EFI to appropriately measure categorical affective states relevant to the exercise experience. Through a series of studies the data also provide evidence that the EFI has content, concurrent, and discriminant validity as well as strong internal consistency. Since their initial research, this scale has been used in a substantial amount of research examining affective responses to acute exercise (Focht, 2009; Raedeke, Focht, & Scales, 2007).

Physical Activity Enjoyment Scale (PACES)

Measuring exercise enjoyment is important in this study since one objective of the study is to examine the enjoyment of the two different reading distractions. To measure enjoyment the PACES scale was used. For the PACES, participants rated on a bipolar 7 point scale (4 meaning neutral) in response to the 18 items such as “I felt interested” and “It felt pleasurable” depending on their level of enjoyment of the activity. The PACES was developed by Kendzierski and DeCarlo (1991) in attempt to create a scale that measures exercise enjoyment. Initially, the authors gathered all the terms related to

physical activity enjoyment in current literature and through interviews. Experts in the field narrowed the items to 19. Kendzierski and DeCarlo then examined internal consistency by having college aged males and females fill out the PACES after their exercise on a stationary bicycle and an abdominal workout machine in the student fitness center. Only one item had a correlation lower than 0.30 when compared to the total score so it was removed and the PACES has a total of 18 items with high internal consistency as shown by Cronbach's alpha = 0.93.

In the first of two validation studies, 37 college-aged males and females exercised on the stationary bicycle lasting 20 minutes for two different sessions. One session was exercise only while the other session allowed participants to listen to their choice of music while exercising. Participants were also classified as boredom prone or not as measured by the boredom proneness scale. The PACES revealed that participants enjoyed the exercise session while listening to their choice of music over the lab control session. Those that were classified as boredom prone also had lower scores on the PACES.

In the second study participants completed three exercise sessions. For the first session participants were randomly assigned to either stationary bicycling or jogging on a mini trampoline and performed the other at the second session. The third session participants were given a choice on which exercise to complete. The authors hypothesized that participants would choose the exercise condition in which they reported the highest post exercise PACES scores. This was true for 23 out of 34 participants. Cumulatively these studies reveal adequate validity and reliability for the PACES to be used to measure exercise enjoyment.

In addition to the 18-item PACES, a shorter version of the PACES has been developed using only 8 of the items. Raedeke (2007) developed this shorter scale that accurately reflected exercise enjoyment assessed via the longer scale. In selecting the 8-items, Raedeke retained items that assessed the enjoyment itself and not potential antecedents and consequences of it. The 8 items remaining in the scale strongly correlated ($r = 0.94$) with the complete scale, therefore item deletion did not adversely effect the scale's psychometric properties.

Leisure Time Exercise Questionnaire (LTEQ)

This questionnaire was used to confirm the participants were regularly active. To complete this measure, participants reported frequency of mild, moderate, and strenuous physical activities they engage in throughout a typical week (Godin & Shephard, 1985). This questionnaire has been shown to be a valid and reliable measure in past research (Jacobs, Ainsworth, Hartman, & Leon, 1993). Participants needed to report activity levels that met the activity recommendations by American College of Sports Medicine. These activity levels are described as 5 days per week of moderate intensity activity lasting 30 minutes, or 3 days per week of vigorous intensity exercise lasting 20 minutes each day. For the present study, activity levels were determined by what students self-reported for the frequency and duration of moderate and vigorous physical activities. If the frequency and duration of their reported activity levels met the ASCM guidelines, then participants were able to participate in the study.

Ratings of Perceived Exertion (RPE)

This measure provided information regarding how hard participants perceived they were working during the exercise session. Borg's 0-10 scale was used (Borg, 1973) which is theorized to reflect the psychobiological relationship between perceived effort and sensations associated with that effort. This scale is frequently used in research studies to gain feedback on individuals' perception of exercise intensity.

Data Analysis

Descriptive statistics were performed to describe the nature of the sample including age, gender, race, height, weight, BMI, classification, and major. To examine whether the two exercise conditions were equivalent on exercise intensity, a 2 (condition) X 2 (time) repeated measured ANOVA was conducted. Correlations comparing the mid and ending heart rates for each condition were calculated. To compare RPE between the sessions, a paired-samples t-test and correlation analysis was performed.

To examine whether the nature of the reading material influenced affective responses on affective valence and activation, a 2 (condition) X 3 (time) repeated measures ANOVA was conducted for the FS and the FAS. Effect size was also calculated using Cohen's delta to examine the magnitude of these changes from pre to mid, mid to post, and pre to post exercise. Effect size was calculated by dividing the mean difference between groups by the pooled standard deviation. Cohen's delta values ≤ 0.2 are considered small, values near 0.5 are moderate, and values ≥ 0.8 show a large effect size. To assess changes in the EFI subscales, a 2 (condition) X 2 (time) repeated measures ANOVA was performed. Effect size was also calculated to examine the strength of mean

differences. To examine the effect of exercise and reading material on SACL responses, a 2 (condition) X 2 (time) repeated measures ANOVA was performed and effect sizes were calculated. Cohen's delta was computed for each affective responses pre to post exercise to determine the magnitude of change.

To examine enjoyment and attention differences between the two conditions, t-tests were performed and effect sizes (Cohen's delta) were calculated. To look at how enjoyment and attention related to post-exercise affect and affective state changes, correlations of enjoyment with post exercise affect and residualized change scores pre to post were performed.

To examine affective changes 60 minutes post exercise, a 2 (condition) X 3 (time) repeated measured ANOVA was used for the FS, FAS, EFI, and SACL. Effect size (Cohen's delta) was calculated comparing pre and 60 min post, as well as post and 60 minute post affect responses. Additionally, correlation analysis was conducted to compare enjoyment and attention subscales to 60 minute post affective state responses.

CHAPTER 4: RESULTS

Thirty-six physically active college-age students (*M* age=20.69 years, *SD*= 2.19) were recruited from a variety of Lifetime Physical Activity and Fitness classes at East Carolina University. Descriptive statistics of the participants can be found in Table 1. The sample included freshmen (n=9), sophomores (n=8), juniors (n=6), seniors (n=10) with three students attending longer than four years. Most of the sample was Caucasian (n=33), however the sample also included African American (n=1), Asian (n=1), and Hispanic (n=1) participants. A range of 14 majors were represented among the sample with only 10 participants reporting Exercise and Sport Science as their major. Males (n=15) had a mean height of 70.4 inches (*SD* = 2.3), a weight of 176.4 pounds (*SD* = 21), and a body mass index (BMI) of 25.1 kg/m^2 (*SD* = 3.5). Females (n=21) had a mean height of 64.5 inches (*SD* = 2.6), a weight of 145.6 pounds (*SD* = 23.7), and a BMI of 24.5 kg/m^2 (*SD* = 3). On average, participants reported exercising 4.8 days per week (*SD* = 1.3). Participants also reported whether or not they normally read during exercise. One participant reported they did and five participants reported sometimes reading during exercise. When asked what they normally read, participants reported that they read magazines and one participant reported to sometimes read journal articles.

Table 1

Participant demographics and activity level

	M	*SD*
Age (years)	20.7	2.2
Height (in.)		
Males	70.4	2.3
Females	64.5	2.6
Weight (lb.)		
Males	176.4	21.0
Females	145.6	23.7
Body-mass index (kg/m²)		
Males	25.1	3.5
Females	24.5	3.0
LTEQ (sessions/week)		
Strenuous	4.3	2.4
Moderate	8.1	17.2
Mild	18	35.0
Mid exercise heartrate		
School reading	122.8	11.6
Pleasure reading	120.6	12.0
End exercise heart rate		
School reading	123.4	11.8
Pleasure reading	122.1	11.5
RPE (during exercise)		
School reading	2.8	1.0
Pleasure reading	2.8	1.1

To ensure the two exercise conditions were equivalent in terms of exercise intensity, exercise heart rate was recorded at the midpoint and at the end of each exercise session. To evaluate heart rate differences a 2 (condition) X 2 (time) repeated measures ANOVA was performed. This analysis did not show a main effect for condition, $F(1, 35) = 2.57$, $p = 0.22$, time, $F(1, 35) = 1.54$, $p = 0.12$, or condition by time interaction, $F(1, 35) = 1.14$, $p = 0.29$. Therefore, participants' heart rate did not significantly change over

time, across reading conditions, or change between exercise and reading conditions. Heart rates reported mid exercise in each condition were strongly correlated ($r = 0.68$). Additionally, ending heart rates were strongly correlated ($r = 0.79$). Based on heart rate, participants exercised at a moderate intensity for both sessions. Through paired-sample t-test analysis, results showed participants did not report significantly different RPE during exercise for each condition, $t(1, 35) = -0.21$, $p = 0.84$. Correlation analysis revealed participants perceived their exercise intensity about the same for both conditions ($r = 0.73$).

Effects of Reading Material on Affective Valence and Activation

To examine whether pleasure versus school related reading material influenced affective valence (FS) and activation (FAS), a 2 (condition) X 3 (time) repeated measures ANOVA was computed. Results of these analyses can be found in Table 2 and Table 3. For the FS, this analysis revealed a significant effect for time, $F(1, 35) = 9.26$, $p = 0.001$, condition, $F(1, 35) = 5.16$, $p = 0.02$, and condition by time interaction, $F(1, 35) = 5.97$, $p = 0.006$ (Figure 2). Reading school related material resulted in a small but negative change in affective valence pre to during ($d = -0.16$) exercise, whereas reading for pleasure resulted in a moderate positive change ($d = 0.48$). Based on effect size (Cohen *d*), reading school related material during exercise showed a small but positive increase in affective valence ($d = 0.16$) pre to post. In comparison, reading for pleasure showed a moderate to large increase in affective valence ($d = 0.68$) pre to post.

Table 2

Pre, mid, and post exercise changes in affect

	Pre			Mid		Post		
	M	SD	α	*M*	SD	*M*	SD	α
Feeling Scale								
School	2.28	1.80		2.00	1.70	2.56	1.63	
Pleasure	2.28	2.11		3.14	1.44	3.47	1.38	
Felt Arousal Scale								
School	3.11	1.06		3.53	1.23	3.64	1.10	
Pleasure	3.53	1.06		4.11	1.90	4.14	1.07	
Calm								
School	3.40	0.76	0.79			3.31	0.82	0.85
Pleasure	3.57	0.81	0.87			3.53	0.54	0.61
Energy								
School	2.75	0.84	0.86			3.14	0.86	0.90
Pleasure	3.00	0.78	0.85			3.56	0.77	0.88
Tension								
School	1.67	0.75	0.90			1.50	0.70	0.91
Pleasure	1.71	0.70	0.87			1.40	0.43	0.80
Tiredness								
School	2.38	0.97	0.82			2.19	0.77	0.70
Pleasure	2.25	0.84	0.77			2.03	0.73	0.75
Revitalization								
School	2.42	0.87	0.78			3.02	0.91	0.87
Pleasure	2.61	0.89	0.84			3.32	0.82	0.79
Tranquility								
School	3.23	1.00	0.87			3.25	0.85	0.86
Pleasure	3.35	0.93	0.87			3.44	0.77	0.81
Exhaustion								
School	2.33	1.00	0.84			2.09	0.87	0.84
Pleasure	2.12	0.93	0.86			1.82	0.79	0.84
Positive Engagement								
School	3.01	0.92	0.82			3.14	0.86	0.83
Pleasure	3.20	0.97	0.88			3.58	0.90	0.80

Table 3

School and pleasure reading comparisons on affective state responses to exercise

	Wilks Lambda	*F*	*p*	Partial Eta Squared
Feeling Scale				
Condition	0.87	5.16	0.03	0.13
Time	0.65	9.26	0.001	0.35
Condition X Time Interaction	0.74	5.97	0.01	0.26
Felt Arousal Scale				
Condition	0.80	8.89	0.005	0.20
Time	0.56	13.47	0.0001	0.44
Condition X Time Interaction	0.98	0.30	0.75	0.02
Calm				
Condition	0.89	4.20	0.48	0.11
Time	0.99	0.53	0.47	0.02
Condition X Time Interaction	1.00	0.06	0.81	0.002
Energy				
Condition	0.85	5.97	0.02	0.15
Time	0.56	26.09	0.0001	0.44
Condition X Time Interaction	0.96	1.37	0.25	0.04
Tension				
Condition	1.00	0.06	0.81	0.002
Time	0.59	21.27	0.0001	0.41
Condition X Time Interaction	0.97	0.94	0.34	0.03
Tiredness				
Condition	0.98	0.73	0.40	0.02
Time	0.88	4.67	0.04	0.12
Condition X Time Interaction	1.00	0.10	0.75	0.003
Revitalization				
Condition	0.90	3.70	0.06	0.10
Time	0.46	41.19	0.0001	0.54
Condition X Time Interaction	0.98	0.69	0.41	0.02
Tranquility				
Condition	0.92	2.88	0.10	0.08
Time	0.99	0.37	0.55	0.01

Table 3 continued.

Condition X Time Interaction	1.00	0.10	0.76	0.003
Exhaustion				
Condition	0.95	1.79	0.19	0.05
Time	0.90	5.60	0.02	0.14
Condition X Time Interaction	1.00	0.11	0.74	0.003
Positive Engagement				
Condition	0.90	4.00	0.05	0.10
Time	0.78	9.77	0.004	0.22
Condition X Time Interaction	0.89	4.41	0.04	0.11

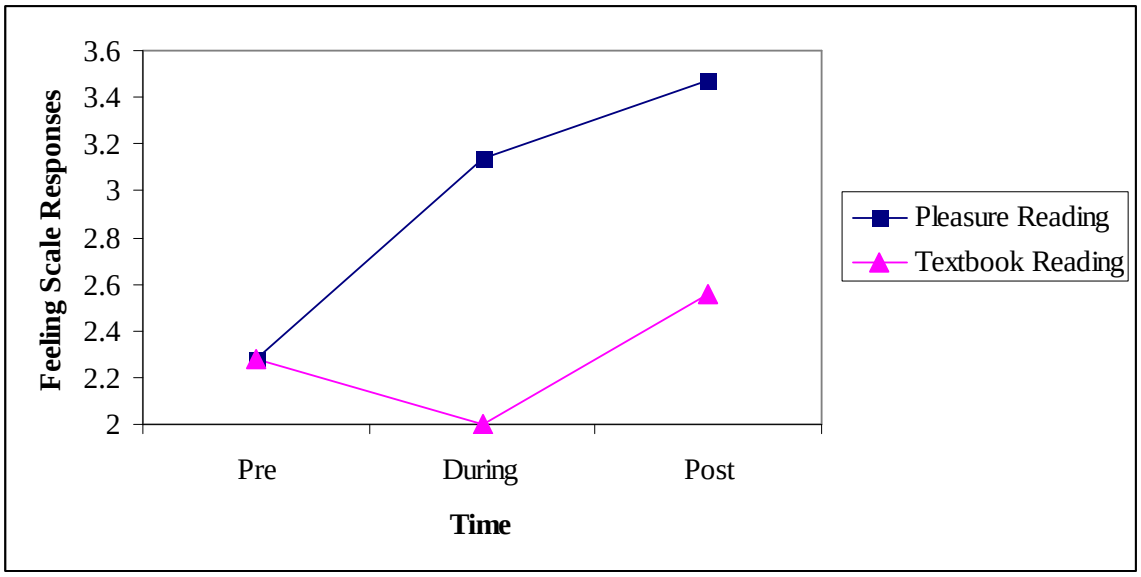

Figure 2: Feeling Scale responses pre, during, and post exercise for each condition

To evaluate the activation dimension, a 2 (condition) X 3 (time) repeated measures ANOVA was computed. This analysis revealed a significant effect for time, $F(1, 35) = 13.47$, $p = 0.0001$ and condition, $F(1, 35) = 8.89$, $p = 0.005$. Participants felt more activated during and after exercise. Across the two time periods, participants felt more activated when reading for pleasure compared those periods when reading for school. However, a significant interaction was not observed, $F(1, 35) = 0.30$, $p = 0.75$. Reading for pleasure showed a positive moderate change pre to during exercise ($d = 0.54$). Similarly, reading school related material showed a small but positive change in arousal pre to during exercise ($d = 0.37$). Based on effect size examination, both school reading and pleasure reading showed a moderate change in activation pre to post exercise ($d = 0.49$ and $d = 0.57$ respectively).

Effects of Reading Material on Positive and Negative Affect

To ensure the subscales were reliable, alpha coefficients were calculated (Refer back to Table 2). The subscales showed adequate reliability with the alpha coefficients ranging from 0.61 – 0.91 for the SACL and the EFI. The alpha coefficient for the calm subscale had the lowest reliability post exercise and pleasant reading ($\alpha = 0.61$), however removing any of the items from the subscale further lowered reliability.

To examine whether pleasure reading versus school oriented material influenced affective responses on positive and negative affect, the investigator ran a series of four 2 (condition) X 2 (time) repeated measures ANOVA's (Refer back to Table 2). For the energy subscale of the SACL, this analysis revealed a significant main effect for condition, $F(1, 35) = 5.97$, $p = 0.02$ and time, $F(1, 35) = 26.09$, $p = 0.0001$, however no

interaction effect was observed. The data indicated that individuals felt more energized before and after exercise when reading for pleasure compared to school, and energy increased over time for both exercise conditions. Based on effect size, reading school related material condition resulted in a moderate change in energy (d = 0.46) and a moderate to large change (d = 0.72) in the pleasure reading condition. For tiredness, the analysis revealed a main effect for time, $F(1, 35) = 4.67$, $p = 0.04$, but no condition main effect or interaction was observed. Effect size reveals both school reading and pleasure reading conditions produced small decreases in tiredness (d = -0.22, d = -0.28, respectively).

In the negative affect dimension, a main effect for time, $F(1, 35) = 21.27$, p = 0.0001 was observed for the tension subscale. While no main effects were shown for condition or condition by time interaction, effect size analysis reveals a small decrease in tension was observed for the school reading condition (d = -0.25) and a moderate decrease for the pleasure reading condition (d = -0.55). For the calmness subscale, no significant main effects were observed and effect sizes showed very small decreases for this subscale resulting from the school reading (d = -0.11) and pleasure reading (d = -0.06) exercise conditions.

Effects of Reading Material on EFI Subscales

To examine whether reading pleasure versus school oriented material influenced affective responses on EFI subscales, we ran a series of four 2 (condition) X 2 (time) repeated measures ANOVA's (Refer back to Table 2). For positive engagement, this analysis revealed a significant effect for condition, $F(1, 35) = 4$, p = 0.05 and time, $F(1,$

35) = 9.77, p = 0.004, and a condition by time interaction, F(1, 35) = 4.41, p = 0.04. Inspection of the mean scores revealed that overall participants reported higher engagement in the pleasure reading condition, M = 3.58 than school reading, M = 3.14 post exercise. Based on effect size, reading school related material during exercise resulted in a small positive change in positive engagement (d = 0.15). In comparison, reading for pleasure during exercise showed a moderate change in positive engagement (d = 0.41).

Similarly, revitalization also showed a significant main effect for time, F(1, 35) = 41.19, p = 0.0001 revealing participants felt more revitalized across time. The main effect for condition approached, but did not reach significance, F(1, 35) = 3.70, p = 0.06. No interaction effect was observed F(1, 35) = 0.69, p = 0.41. Based on effect size, reading school related material during exercise showed a moderate to large increase in revitalization (d = 0.67). Additionally, the reading for pleasure group showed a large positive change (d = 0.83). Further analysis revealed there was no condition main effect for physical exhaustion, F(1, 35) = 1.79, p = 0.19, or a time by condition interaction, F(1, 35) = 0.11, p = 0.74. However, a time main effect was observed F(1, 35) = 5.6, p = 0.02 revealing participants felt less exhausted across time. Both the school reading and pleasure reading conditions resulted in a small decrease in physical exhaustion (d = -0.26, d = -0.35 respectively). No significant differences in tranquility were observed across time, F(1, 35) = 0.37, p = 0.55, for condition, F(1, 35) = 2.88, p = 0.10, or condition by time interaction, F(1, 35) = 0.10, p = 0.76. Examination of effect sizes showed very small changes in the school (d = .03) and pleasure (d = 0.11) reading exercise conditions.

Condition Differences on Enjoyment

Overall, students reported higher enjoyment for the pleasure reading (M = 5.2, SD = 0.99) compared to school reading (M = 4.1, SD = 1.11) (Figure 3) with the effect size being large in magnitude (d = 1.04). Results of a paired-sample t-test analysis show participants reported greater enjoyment, $t(1, 33) = 4.55$, $p = < 0.0001$ for pleasure reading during exercise versus school reading.

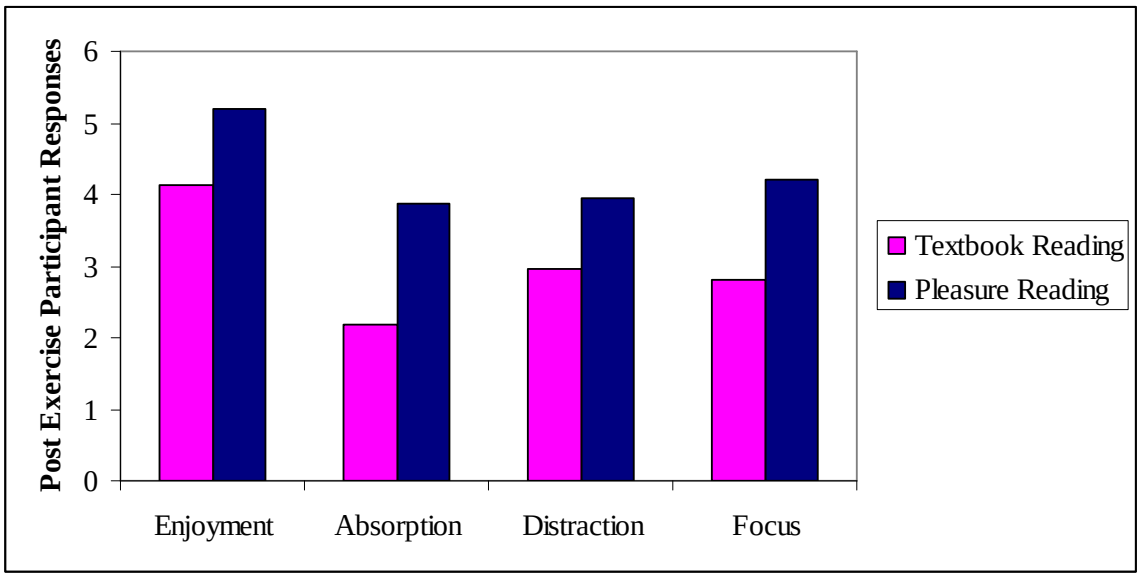

Figure 3: Mean scores of attention subscales and enjoyment for each reading condition

Condition Differences on Attentional Focus

Inspection of the mean scores shows participants reported higher attention scores when they were reading for pleasure than when reading school related material (Table 4). Paired-samples t-test revealed participants had greater absorption, $t(1, 35) = 8.6$, p = 0.0001, distraction, $t(1, 34) = 5.10$, $p = 0.0001$, and focus, $t(1, 35) = 8.58$, $p = 0.0001$, for the pleasure compared to school reading conditions. The magnitude of the mean

differences between the conditions is large as shown by effect size for absorption (*d* = 1.98), distraction (*d* = 1.09), and focus (*d* = 1.85).

Table 4

Condition mean differences for enjoyment and attention subscales

	M	SD
Enjoyment		
School	4.14	1.11
Pleasure	5.20	0.99
Absorption		
School	2.17	0.85
Pleasure	3.88	0.89
Distraction		
School	2.97	1.06
Pleasure	3.94	0.72
Focus		
School	2.81	0.83
Pleasure	4.21	0.68

Relationship between Enjoyment and Attention on Affective Responses

Correlations between enjoyment and attention (absorption, distraction, and focus) with post exercise affect and residualized change scores from pre to post are reported in Table 5. These results show that feeling scale changes from pre to post moderately correlated with enjoyment, absorption and attentional focus. Additionally, post exercise feeling scale responses positively correlated with enjoyment and attention with that relationship being in the moderate to strong range. Likewise, arousal post exercise responses moderately correlated with enjoyment, absorption, and focus. For SACL, those

reporting higher enjoyment and attention (i.e., absorption, distraction, focus) felt more energized, calm, and less tense post exercise.

Table 5

Correlation of enjoyment and attention with affective responses

	Enjoyment	Absorption	Distraction	Focus
Feeling scale change	0.24*	0.26*	0.14	0.31**
Feeling scale post	0.45**	0.51**	0.43**	0.49**
Felt arousal scale change	0.08	0.21	0.49	0.21
Felt arousal scale post	0.37**	0.45**	0.17	0.37**
Calm change	-0.13	0.02	0.09	0.09
Calm post	0.02	0.21	0.31**	0.24*
Energy change	0.23	0.23	0.09	0.16
Energy post	0.42**	0.45**	0.38**	0.36**
Tension change	-0.10	-0.37	-0.18	-0.08
Tension post	-0.11	-0.15	-0.35**	-0.17
Tired change	-0.05	-0.07	-0.11	-0.08
Tired post	-0.17	-0.17	-0.26*	-0.20
Revitalization change	0.21	0.22	0.13	0.22
Revitalization post	0.35**	0.37**	0.39**	0.34**
Tranquility change	-0.01	0.04	0.16	0.10
Tranquility post	0.06	0.18	0.34**	0.22
Exhaustion change	0.05	0.002	-0.18	-0.02
Exhaustion post	-0.16	-0.19	-0.25*	-0.23*
Positive engagement change	0.21	0.06	-0.01	0.01
Positive engagement post	0.40**	0.38**	0.35**	0.30**
Enjoyment		0.68**	0.49**	0.60**
Absorption			0.58**	0.82**
Distraction				0.54**

*Correlation is significant at the p = <0.05 level (2-tailed).
**Correlation is significant at the p = <0.01 level (2-tailed).

Cumulatively, post exercise responses for affective valence, activation, energy/calmness dimensions of the SACL were higher for participants reporting higher

enjoyment and attentional focus while exercising. Additionally, the more participants were distracted by the reading, the lower the tension responses were post exercise. Overall, post exercise affect was more strongly correlated with enjoyment and attention compared to changes in affect.

For the categorical affective responses, revitalization and positive engagement post exercise scores moderately correlated with enjoyment, absorption, distraction, and focus. Overall, improved revitalization and positive engagement scores were reported when participants reported higher enjoyment and attention to the reading. Responses for tranquility moderately correlated only with distraction. Tranquility was less influenced by enjoyment; however individuals reporting higher feelings of tranquility also reported higher distraction of the reading during exercise. Post exercise responses for exhaustion inversely correlated with distraction and focus with the correlations being in the moderate range. Exhaustion scores showed a trend to decrease when responses the reading provided a greater distraction and when the participant focused on the reading.

In summary, the correlations support that higher enjoyment and attentional focus during exercise related to higher positive and lower negative affect post exercise. Higher enjoyment and attentional focus also was associated with improved affective valance pre to post exercise. However, enjoyment and attentional focus were unrelated to changes in other affective state measures. Correlations between enjoyment, absorption, distraction, and focus were strong, ranging from 0.49 to 0.82, and significant at the $p < 0.01$ level. Therefore, participants who reported higher enjoyment also reported higher attentional focus during the exercise session while reading.

Affective Responses for the FS, FAS, and SACL 60 Minutes Post Exercise

Initially we had 36 participants; however data was lost due to lack of compliance for the 60 minute post assessment. For the 60 minute responses, some participants took the survey on the wrong day (N = 2), some forgot to include their name upon submission (N = 5), and some participants took the survey more than two hours past the allotted time period (N =11), therefore data was lost because of these factors. Therefore, the 60 minute post analyses were performed with a subsample of N = 18. To maximize participant responses, data was replaced for two participants. The missing data was replaced with the participants' mean score on the remaining items on the subscales. For one participant, an item was replaced on the calm subscale, and for the other participant an item was replaced for the tension subscale.

Means and standard deviations of the 60 minute post exercise responses can be found in Table 6. To examine 60 minutes post exercise affective valence, activation and SACL responses, a 2 (condition) X 3 (time) repeated measures ANOVA was computed (Table 7). Affective valence showed a main effect for time, $F(1, 17) = 4.45$, $p = 0.03$, and a condition by time interaction, $F(1, 17) = 3.71$, $p = 0.05$. Participants felt better over time, and the pleasure reading reported higher score for affective valence, and those in the pleasant reading group experienced more positive feeling states. Effect size reveals participants showed a moderate change in affective valence pre to 60 minute post exercise for school reading ($d = 0.52$) and in the reading for pleasure condition ($d = 0.67$). Affective valence moderately increased from post exercise to 60 minutes post exercise for the school reading condition ($d = 0.47$), whereas affective valence post and 60

minutes post resulted in a very small decrease for the pleasure reading group (d = -0.09) (Figure 4). Inspection of the means reveal the reading for pleasure condition reported higher affective valence post exercise (M = 3.82) compared to the textbook reading (M = 2.65). Furthermore, the pleasure reading condition maintained improved affective valence 60 minutes later (M = 3.71), whereas participants reported higher feeling scale responses 60 minutes post exercise (M = 3.47) than post exercise.

Table 6

Means and standard deviations of affective responses pre, post and 60 minutes post exercise

	Pre		Post		60 minutes post	
	M	SD	*M*	SD	*M*	SD
Feeling Scale						
School	2.53	1.94	2.65	1.80	3.47	1.66
Pleasure	2.59	2.18	3.82	1.24	3.71	1.16
Felt Arousal Scale						
School	3.06	1.00	3.61	0.92	3.39	1.24
Pleasure	3.61	0.98	4.28	1.02	3.28	1.49
Calm						
School	3.56	0.68	3.35	0.85	3.61	0.58
Pleasure	3.88	0.63	3.54	0.54	3.56	0.85
Energy						
School	2.75	0.93	3.11	0.97	2.70	0.82
Pleasure	3.23	0.65	3.67	0.65	2.88	0.81
Tension						
School	1.59	0.57	1.38	0.46	1.42	0.64
Pleasure	1.63	0.54	1.45	0.42	1.46	0.56
Tiredness						
School	2.49	1.03	2.24	0.74	2.19	0.48
Pleasure	2.34	0.91	2.13	0.75	2.22	0.92

Table 6 continued.

Revitalization						
School	2.65	0.89	2.94	0.94	2.70	0.96
Pleasure	2.72	0.89	3.43	0.69	3.06	0.94
Tranquility						
School	3.39	0.97	3.22	0.89	3.33	1.00
Pleasure	3.63	0.71	3.44	0.86	3.24	0.81
Physical Exhaustion						
School	2.25	0.97	2.04	0.73	2.02	0.71
Pleasure	2.20	0.95	1.84	0.78	1.93	0.84
Positive Engagement						
School	3.17	1.00	3.19	0.97	2.98	0.91
Pleasure	3.31	0.89	3.72	0.70	3.31	0.91

Table 7

School and pleasure reading comparisons on affective state responses 60 minutes post exercise

	Wilkes Lambda	*F*	*p*	Partial Eta Squared
Feeling Scale				
Condition	0.90	1.84	0.19	0.10
Time	0.63	4.45	0.03	0.37
Condition X Time Interaction	0.70	3.71	0.05	0.33
Felt Arousal Scale				
Condition	0.82	3.79	0.07	0.18
Time	0.57	6.09	0.01	0.43
Condition X Time Interaction	0.84	1.56	0.24	0.16
Calm				
Condition	0.86	2.79	0.11	0.14
Time	0.77	2.41	0.12	0.23
Condition X Time Interaction	0.79	2.16	0.15	0.21
Energy				
Condition	0.73	6.02	0.03	0.27
Time	0.45	9.30	0.002	0.55
Condition X Time Interaction	0.81	1.76	0.21	0.19
Tension				
Condition	0.97	0.51	0.49	0.03
Time	0.63	4.09	0.04	0.37

Table 7 continued.

Condition X Time Interaction	1.00	0.02	0.99	0.002
Tiredness				
Condition	0.99	0.14	0.71	0.01
Time	0.86	1.19	0.33	0.14
Condition X Time Interaction	0.97	0.20	0.82	0.03
Revitalization				
Condition	0.78	4.85	0.04	0.22
Time	0.63	4.66	0.03	0.37
Condition X Time Interaction	0.61	5.03	0.02	0.39
Tranquility				
Condition	0.95	0.92	0.35	0.05
Time	0.81	1.86	0.19	0.19
Condition X Time Interaction	0.83	1.68	0.22	0.17
Exhaustion				
Condition	1.00	0.05	0.82	0.003
Time	0.77	2.24	0.14	0.23
Condition X Time Interaction	0.92	0.70	0.51	0.09
Positive Engagement				
Condition	0.85	2.93	0.11	0.15
Time	0.75	2.17	0.10	0.25
Condition X Time Interaction	0.82	1.81	0.20	0.18

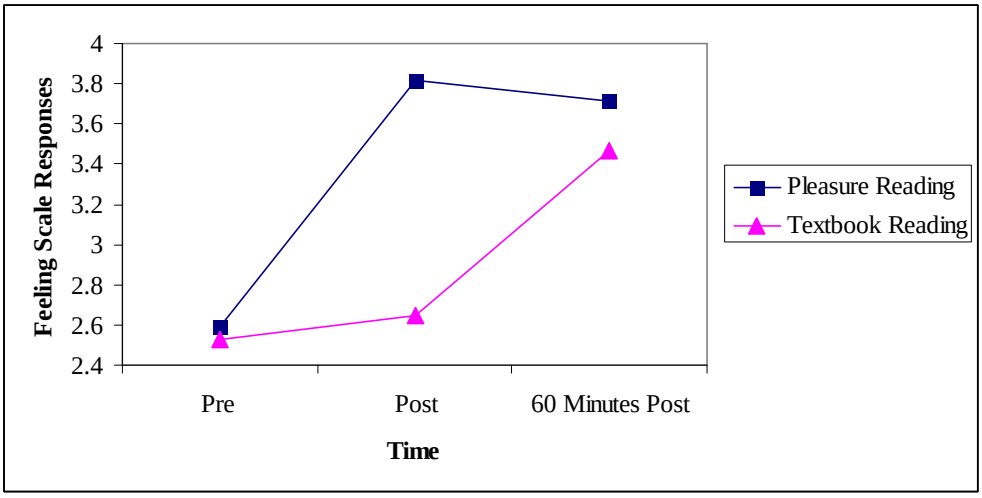

Figure 4: Feeling scale responses pre, post, and 60 minutes post exercise

Activation showed a significant main effect for time as well, $F(1, 17) = 6.09$, $p = 0.01$. Participants reported small decreases in activation from post exercise to 60 minutes post in the school reading condition ($d = -0.20$) and a large decrease for the pleasure reading condition ($d = -0.80$). Overall, activation responses for both groups increased from pre to post test, and decreased 60 minutes post exercise with the decrease being large for the pleasure group and small for the school group.

For the positive and negative affect dimensions of the SACL a 2 (condition) X 3 (time) repeated measures ANOVA was calculated. This analysis revealed a significant energy main effect for condition, $F(1, 17) = 6.02$, $p = 0.03$ and time, $F(1, 17) = 9.30$, $p = 0.002$. Tension showed a main effect for time, $F(1, 17) = 4.09$, $p = 0.04$. Further analysis of effect size indicated participants reported a moderate decrease in energy from post to 60 minutes post exercise for the school reading condition ($d = -0.46$) and a large decrease post to 60 minutes post exercise for the pleasure reading condition ($d = -1.08$). Small decreases in tension from pre to 60 minutes post exercise were also observed for the school reading condition ($d = -0.28$) and for the pleasure reading condition ($d = -0.31$). Cumulatively, responses for the SACL showed participants felt less energy (Figure 5) and less tension 60 minutes post exercise compared to pre and post exercise responses, regardless of condition.

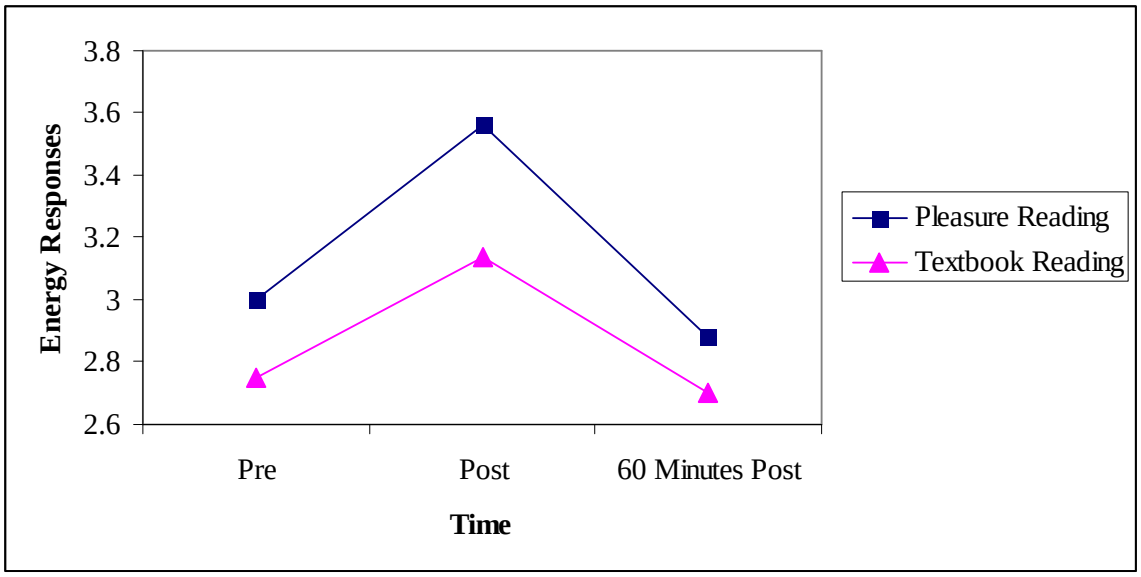

Figure 5: Responses for the energy subscale of the SACL pre, post, and 60 minutes post exercise

Affective Responses for the EFI 60 Minutes Post Exercise

To examine whether reading pleasure versus school related material influenced affective responses 60 minutes post exercise on EFI subscales, a 2 (condition) X 3 (time) repeated measures ANOVA's was performed (Refer back to Table 7). This analysis revealed a significant main effect for condition $F(1, 17) = 4.85$, $p = 0.04$, time, $F(1, 17) = 4.66$, $p = 0.03$ and condition by time interaction, $F(1, 17) = 5.03$, p = 0.02 for the revitalization subscale of the EFI (Figure 6). Further examination of effect size shows participants reading school related material did not feel more revitalized after the exercise ($d = 0.05$) and felt a small decrease from post to 60 minutes post ($d = -0.25$). The pleasure reading group showed improvements in revitalization pre to post exercise ($d = 0.83$). From post to 60 minutes post exercise the feelings of revitalization showed a moderate

decrease (*d* = -0.45) for the pleasure reading condition. However, 60 minute post exercise responses were still improved from pre test as shown by effect size (*d* = 0.37). Inspection of the mean scores show revitalization 60 minutes post exercise was felt more by participants reading for pleasure (*M* = 3.31) than 60 minutes post exercise of the school reading condition (*M* = 2.98).

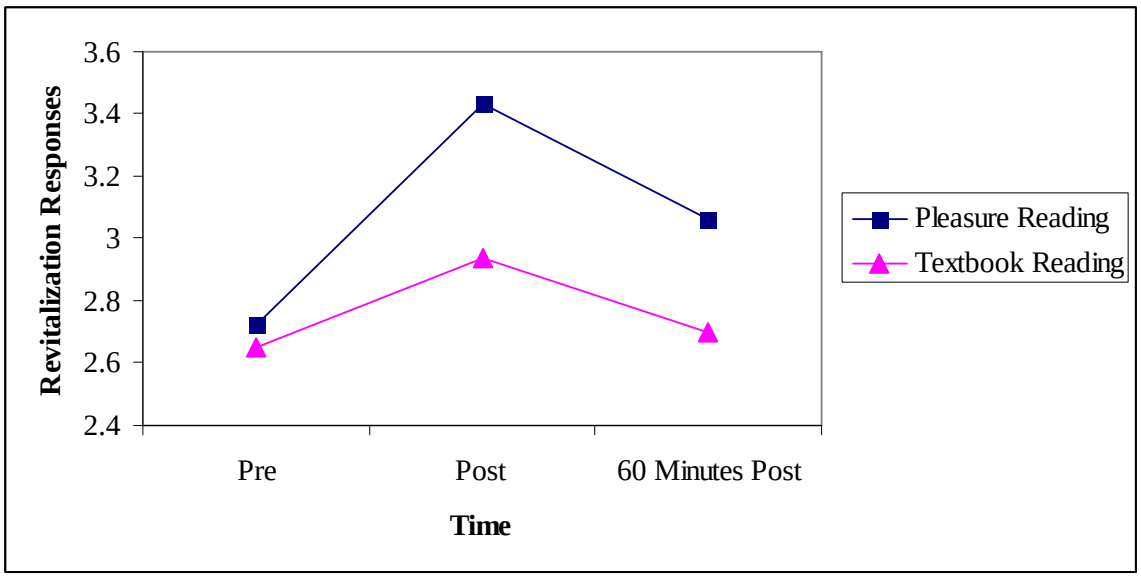

Figure 6: Revitalization responses pre, post, and 60 minutes post exercise for each condition

For positive engagement, no main effect emerged for time or condition, nor was a significant condition by time interaction observed. Effect size analysis for positive engagement scores showed a small decrease from post to 60 minutes post exercise for the textbook reading condition (*d* = -0.22) (Figure 7). Additionally, effect size shows a moderate decrease in positive engagement from post to 60 minutes post exercise in the pleasure reading group (*d* = -0.51). For exhaustion, repeated measures ANOVA showed

no main effect for time or condition, and no significant condition by time interaction emerged. Effect size analysis showed participants in the school reading condition felt a small decrease in exhaustion pre to 60 minutes post exercise (*d* = -0.27) as well as in the pleasure reading condition (*d* = -0.30).

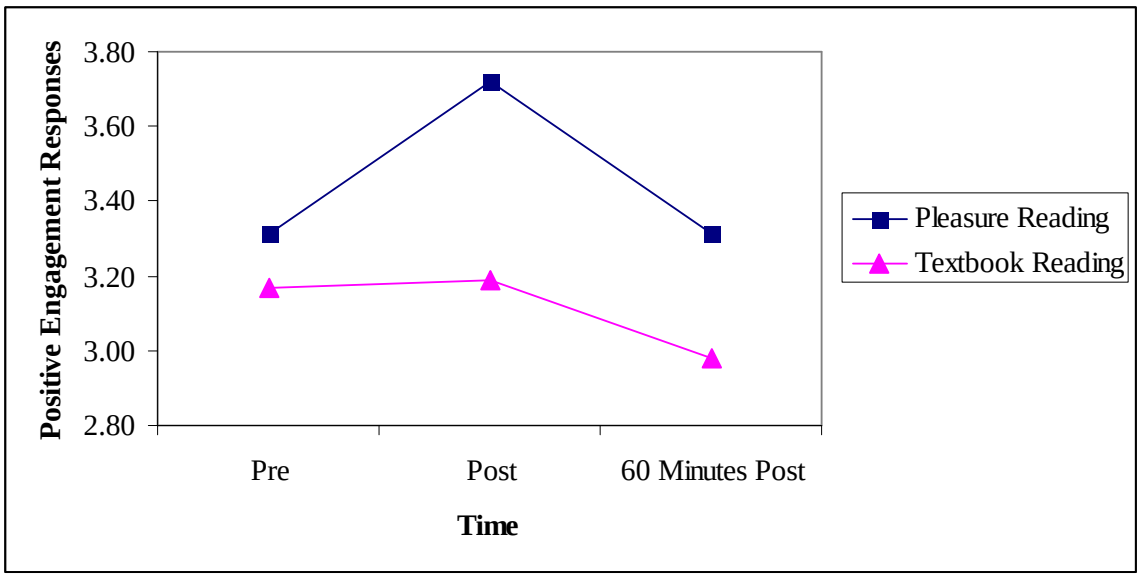

Figure 7: Positive engagement responses pre, post, and 60 minutes post exercise for both conditions

Relationship of Enjoyment and Attention with 60 Minute Post Affective Responses

Correlations between enjoyment and attention (absorption, distraction, and focus) with affective responses 60 minutes post exercise scores are reported in Table 8. In general, enjoyment and attention did not correlate with 60 minute post exercise affective responses. However, two significant correlations were observed. The energy subscale of the SACL moderately correlated with enjoyment and this relationship reached statistical

significance ($p < 0.01$). Additionally, the revitalization subscale of the EFI moderately correlated with focus to the reading and this relationship reached statistical significance ($p < 0.05$). These correlations suggest that the higher the enjoyment scores are for the exercise and reading condition, the higher the feelings of energy reported 60 minutes post exercise. Additionally, when participants are more focused on the reading during exercise, the higher feelings of revitalization will be 60 minutes post exercise.

Table 8

Correlation of enjoyment and attention with 60 minute post exercise affective responses

	Enjoyment	Absorption	Distraction	Focus
Feeling scale	0.08	0.03	0.19	-0.04
Felt arousal	0.25	0.10	-0.15	-0.01
Calm	-0.27	-0.01	0.21	0.05
Energy	0.45**	0.23	0.30	0.24
Tension	0.21	-0.10	-0.30	-0.07
Tiredness	-0.04	-0.002	-0.09	-0.03
Revitilization	0.20	0.22	0.14	0.33*
Tranquility	-0.06	0.01	0.33	0.04
Exhaustion	0.08	-0.01	-0.02	-0.03
Positive engagement	0.26	0.22	0.28	0.27

*Correlation is significant at the $p = <0.05$ level (2-tailed).
**Correlation is significant at the $p = <0.01$ level (2-tailed).

CHAPTER 5: DISCUSSION

A large body of research supports that exercise improves transient indicators of psychological well-being including affect (Arent, et al., 2000; Petruzzello, et al., 1991). One plausible explanation for the relationship between exercise and affect is based on distraction hypothesis. In theory, when individuals participate in an exercise session they are taking a time out from their daily worries and life stresses, which leads to improved affect. The distraction hypothesis has yielded mixed results in past research. While the theory is supported in some research (Bahrke & Morgan, 1978; Breus & O'Connor, 1998; Focht & Hausenblas, 2001) unresolved issues remain. Rather than exercise automatically providing a distraction from life stress, it is plausible that enjoyable exercise experiences provide a stronger time out from daily worries compared to exercise that is not enjoyable (Russell et al. 2003). Conversely, if individuals think about life stress while exercising, then exercise may not provide a distraction. This is in line with the assertions by Russell, et al. (2003) who proposed that enjoyable distractions that take the attention away from life stress during exercise could be an important factor influencing affective responses. However, research on this topic has not been conducted.

The purpose of the present study was to examine how a pleasant (i.e., pleasure reading) compared to a less pleasant (i.e., academic reading) distraction activity during exercise impacted affective responses, enjoyment, and attentional focus during the exercise session. Across the two reading conditions, participants were hypothesized to show increases in positive and decreases in negative affect, however the pleasure reading condition was expected to show a more positive affective responses during, post, and 60

minutes post exercise. Both enjoyment and attentional focus were hypothesized to correlate with positive affective responses.

Both exercise sessions produced increases in positive affect. From pre to post exercise, affective valence, activation, energy, positive engagement, and revitalization increased. Decreases in negative affect were also observed for tension, tiredness, and physical exhaustion. As hypothesized, participants reported greater increases in affective valance and positive engagement when reading for pleasure compared to reading school related material. For negative affect, both conditions showed similar decreases. In comparison with Breus and O'Connor (1998) who did not observe decreases in negative affect post exercise for the study condition as was seen in the current study, the difference could be due to participants being given a quiz at the end of the session whereas we did not include a quiz. Additionally, the sample included highly anxious females compared to this present study including both males and females not determined to be highly anxious.

Sixty minutes post exercise reveals the affective benefits regressed toward the baseline levels and for energy, responses were below baseline levels. The decreases in energy were not hypothesized or consistent with existing literature. The low energy may have been due to the time of semester in which students were busy. In comparison, affective valence responses continued to increase 60 minutes post exercise for the school reading condition and remain elevated for the pleasure reading. Contrary to the hypothesis, responses for calmness increased for the school reading condition from pre to 60 minutes post, but no significant changes were seen for the pleasure reading group.

Although affect generally improved post exercise, affective valence increased during the session for the pleasure reading group. For the school reading session affective valence decreased from pre to during exercise. This supports that a pleasant distraction improves feeling states during exercise, whereas one that is related to life stress may result in a person feeling worse during exercise.

As hypothesized, participants reported higher enjoyment and attentional focus when reading for pleasure than for school while exercising. Also, individuals who found exercise to be more enjoyable reported higher attentional focus during exercise. Enjoyment and attentional focus were positively correlated with affective valence, activation, positive affect, revitalization, and positive engagement post exercise. Additionally, participants reporting higher attentional focus during exercise also reported higher feelings of tranquility and lower feelings of tension.

Collectively, results from the current study provide some support for distraction hypothesis (Barhke and Morgan, 1978) in that participants reported higher increases in affective valence during exercise and reported higher affective valence and positive engagement post exercise compared to the school reading condition. The pleasure reading group was afforded more of a time out from life stress than the school reading condition. However, participants did experience improved affect pre to post exercise in both conditions. Furthermore, support was found for Russell et al.'s contention (2003) that the activities designed to distract a person from life stress during exercise need to be enjoyable to enhance mental health. In contrast to the distraction hypothesis, both groups showed similar decreases in negative affect. These findings extend the distraction

hypothesis by showing that the exercise experience needs to be enjoyable and attention absorbing to enhance positive affect.

Adding to the literature on enjoyment and affective responses, the results provide additional support that high enjoyment relates to higher reported affective states (Focht, 2009; Motl, Berger, & Leuschen, 2000; Raedeke, 2007; Raedeke, Focht, & Scales, 2007; Raedeke, Focht, & Scales, 2009). Results parallel findings of Raedeke (2007) and Focht (2009) in that enjoyment was related to positive affect but not to negative affect. However, Raedeke showed that enjoyment was related to changes in affect pre to post exercise whereas in the current study enjoyment was more strongly related to post exercise affect than affective stage changes. These findings support the contention that exercise enjoyment plays an important role in understanding exercise related improvements in positive affect. Furthermore, as Focht (2009) found, enjoyment was related to increases in post exercise feelings of revitalization, positive engagement and affective valence. However, Focht (2009) also found enjoyment to relate to increases in tranquility, which was not the case in the current study.

In addition to enjoyment analysis, Focht (2009) also measured affective valence during exercise. In his study, participants in both walking conditions reported increased affective valence during exercise, however the outdoor walking group reported significantly higher affective valence during exercise. The results of the present study found feelings states to increase pre to during for the pleasant reading condition, however feeling states decreased from pre to during for the textbook reading condition. In previous research, decreases in affective valence responses during exercise were observed due to

increasing intensity (Hall, Ekkekakis, & Petruzzello, 2002; Welch, Hulley, Ferguson, & Beauchamp, 2007). Results of the present study suggest that not only intensity influences affective feeling states, but also the quality of the exercise experience can impact affective responses during exercise.

Affective improvements shortly after acute exercise are currently well documented; however the research examining the duration of improved affect following exercise is minimal. The few studies that examined the temporal dynamics of affective responses found that increases in positive and decreases in negative affect were maintained 60 and 120 minutes post exercise (Daley & Welch, 2004; Focht, 2002; Thayer, 1987). In comparison, the results of the present study show affective responses returned towards baseline 60 minutes post exercise, except for affective valence which continued to increase post exercise for the school reading group and remain elevated for the pleasure condition. Reasons for the contrast could be due to the nature of the exercise session, the tools measuring affect, and the small sample in the present study (N = 18). For example, in the study by Focht (2002) weight lifting was examined and anxiety was measured 5, 20, 60, and 120 minutes post exercise. While decreases in anxiety persisted, no measure assessing positive affect was included in the study by Focht (2002) and anxiety was not measured in the present study. Additionally, Thayer (1987) examined brisk walking in the participants' natural environment for 10 minutes in a sample of young to middle aged adults that were not determined to be regularly active, whereas this study sampled only college students who were regularly active. Therefore, the nature of the exercise and sample were different in Thayer's research from the current study.

Practical Implications for Fitness Professionals

Collectively, the findings of the present study indicate that a distraction tool used during exercise plays a role in affective responses during and post exercise. If a distraction during exercise is enjoyable and attention absorbing, then individuals will feel enhanced affective responses compared to an exercise session where the distraction during exercise is related to daily worries. Pleasure reading enhanced the distraction from life stress and resulted in greater improvement in affective responses compared to school related reading. Fitness professionals can use the information from this study to help structure an exercise session that results in greater improved psychological health for individuals. For example, fitness leaders could encourage individuals to read a favorite book or a book not related to work or life stress issues while exercising on stationary equipment.

One consideration that fitness professionals can learn from this study is how participants felt during exercise. While both exercise sessions improved affective responses post exercise, affective valence decreased for the school reading during exercise. While participants are exercising it is important that they feel good during the exercise as that could possibly influence future exercise behaviors. Many fitness professionals talk to their clients during exercise, it is plausible based on the present study that talking to clients about issues not related to life stress could enhance affective improvements from exercise.

Instructing people to use an enjoyable distraction that they can focus on while exercising is also important. In addition to using distractions, another key to improving

affect through exercise is to help individuals identify exercise activities that they enjoy and find attention absorbing as those activities will likely provide a stronger time out from life stress. With a stronger time out from life stress participants will have a more positive exercise experience than when exercise does not provide much of a time out from life stress. More positive exercise experiences could elicit repeated exercise behaviors, thereby achieving adherence.

Limitations of the Current Study

While the results of the present study provide additional insight into how a distraction during exercise impacts affective responses and contributes to a more comprehensive understanding of the distraction hypothesis, there are several limitations that should be acknowledged. One such issue was the small sample size for the 60 minute post data. The responses obtained could be representative of the entire sample. In examination of the pre and post means of the 18 participants included in the 60 minute post analysis compared to that of the entire sample showed the means appear to be close to that of the entire sample. However, future research measuring affect 60 minutes post exercise with a larger sample would further clarify if affective responses 60 minutes post follow the patterns they did in this study. Additionally, only students at East Carolina University enrolled in Lifetime Physical Activity classes were included in the study. The study was performed close to finals time therefore the students may have felt extra stress being so close to the end of the semester. Although reading school materials may not have provided a time out, it may have provided a sense of accomplishment during a busy time in the semester and thus influenced affective responses such as changes in tension.

Future research could examine whether the results found in this study hold true at different time points in the semester.

The present study did not include an exercise only control group as previous studies have included. However, the purpose of the present study was to compare an enjoyable distraction during exercise to a distraction that does not permit a time out from daily worries and stresses. Finally, time of day was not controlled in this study as other research has when examining exercise and affect (Focht, 2009). However, the majority of participants scheduled their second exercise session at a similar time during the day.

Suggestions for Future Research

Based on the findings in this study, future research should continue investigating the distraction hypothesis as the present student supports it as a possible explanation for exercise related improvements in affective responses. Additional information on the lasting effects of improved affect 60 minutes post exercise is needed as this is one of the few studies to measure affective responses an hour past cessation of exercise. The sample in this study included regularly active students and future research could address whether the results from this study hold true for inactive individuals. Another consideration for future research is to examine different kinds of distractions and reading material. Further research could look at other distraction tools used during exercise such as watching television and examine whether those activities provide an enjoyable distraction, are attention absorbing, and what influence they have on affective responses. While only books were included in the present study as the distraction tool, many people read magazines and newspapers during exercise. Evaluating how reading those kinds of

materials influence enjoyment, attentional focus and affective responses could shed more light on what types of material to read during exercise that is ideal for improving affect. Furthermore, examining how magazines influence affective responses warrants further investigation. Many magazines include pictures of very thin and beautiful women thereby bringing the focus of the reader on physique and that could evoke negative feelings about oneself. Health related magazines may be more ideal for reading during exercise as indicated by the findings of Raedeke et al. (2007). In this study participants enjoyed the exercise class in which the activity leader behavior was health oriented more than the other exercise class where the leader behaviors were physique oriented. Additionally, participants reported enhanced affective responses post the health oriented class compared to the physique oriented class.

Lastly, in further studies examining exercise and affect, research is needed examining affective responses to exercise and reading over the long term. By examining repeated exercise sessions will show if the relationship between the exercise and affect shown in the present study holds true for the long term. Findings could shed light on whether structuring exercise in a way to increase positive and decrease negative affect and providing experiences that are more enjoyable and attention absorbing, such as reading for pleasure, have long term impacts on exercise related motivation and psychological well-being.

Conclusion

In summary, although both exercise sessions resulted in improved affect, greater increases in overall feeling state and positive engagement were seen in the pleasure

reading condition. Additionally, pre to post exercise improvements for activation, energy, tension, tiredness, revitalization, and physical exhaustion were similar between the two conditions. However, given the underdeveloped literature on enjoyment and attentional focus during exercise and their relation to the distraction hypothesis, future research is needed on the role enjoyment and attentional focus have in providing a time out from life stress during exercise. Ultimately, this should lead to a greater understanding of how to structure exercise experiences to increase positive and decrease negative affect in effort to increase exercise adherence and psychological well-being.

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APPENDIX A: INFORMED CONSENT DOCUMENT

Informed Consent Document
Exercise and Mood

Introduction
You are invited to participate in a research study designed to examine your mood states and feelings about exercise. Rachel Day, a graduate student in the Department of Exercise and Sport Science at East Carolina University, is conducting this study for her master's thesis under the supervision of Tom Raedeke, Ph.D., an associate professor in Exercise Psychology. You were selected as a possible participant because of your enrollment in an Exercise and Sport Science course or as a member of the Student Recreation Center.

Plans and Procedures
If you volunteer to participate, you will be asked to exercise for 30-minutes at a self-selected moderate intensity pace on stationary equipment on two different occasions in the Activity Promotion Lab in Minges Coliseum. On one occasion, you will be asked to read something that you find pleasurable. On the other, you will be asked to read a text that you use in one of your courses. You will also be asked to complete a survey that contains questions to assess your stress level, your mood, and your feelings about exercise immediately prior to and after exercise. After leaving the Activity Promotion Lab, you will also be asked to complete the survey one hour post-exercise after being prompted by a phone call reminder. On each occasion, the survey will take around 10 minutes to complete.

Potential Benefits and Risks
Participation in this study is completely voluntary and refusal to participate does not have any negative consequences. Your decision on whether or not to participate will not have any impact on your course grade. Although there are minimal (if any) risks associated with completing the survey, not all risks are predictable. If you experience any emotional discomfort when answering the survey questions or want to stop completing the questionnaire for any reason, you will be free to withdraw your consent and discontinue participation at any time. Although there is a small inherent risk associated with exercise participation, the risk is no greater than you experience in a normal exercise session. If you have health problems that prevent exercising, you should not participate in this study.

Although you may not attain any benefits from this study, results may provide insights that can be used to help ensure that exercise is a positive experience for individuals in the future. In appreciation of your help, you will be given a pedometer valued at approximately $20.

Confidentiality
All questionnaire responses will be kept strictly confidential. Only the researchers associated with this study will have access to the responses to your questionnaire. To further protect your confidentiality, your name does not need to be written on the questionnaire. Published results will not include data from individual surveys, rather results based on the entire sample.

Voluntary Participation
Your participation in this study is completely voluntary and you have the right to discontinue exercising at any point or to stop completing the questionnaire at any time without penalty.

Persons to Contact
If you have any questions, please feel free to contact Rachel Day or Tom Raedeke at the addresses and telephone numbers listed below. If you have questions regarding your rights as a research participant, you may contact the Chairman of the University and Medical Center Institutional Review Board at (252) 744-2914 (days). You can keep the second copy of this form for your records.

Compensation and Treatment for Injury
The policy of East Carolina University and/or Pitt County Memorial Hospital does not provide for payment or medical care for research participants because of physical or other injury that result from this research study. Every effort will be made to make the facilities of the School of Medicine and Pitt County Memorial Hospital available for care in the event of such physical injury.

Consent to Participate
I certify that I have read all of the above and willingly give my consent to participate in this research study.

_____
Participants Name (Print)

_____
Participant's Signature
Date

Rachel Day Department of Exercise and Sport Science East Carolina University Greenville, NC 27858 (252) 328-1996 (day) rmd0323@ecu.edu	Tom Raedeke, Associate Professor Department of Exercise and Sport Science-172 Minges East Carolina University Greenville, NC 27858 (252) 737-1292

APPENDIX B: IRB APPROVAL FORM

University and Medical Center Institutional Review Board
East Carolina University • Brody School of Medicine
600 Moye Boulevard • Old Health Sciences Library, Room 1L-09 • Greenville, NC 27834
Office **252-744-2914** • Fax **252-744-2284** • **www.ecu.edu/irb**
Chair and Director of Biomedical IRB: L. Wiley Nifong, MD
Chair and Director of Behavioral and Social Science IRB: Susan L. McCammon, PhD

TO: Rachel Day, Graduate Student, c/o Dr. Thomas Raedeke, Dept of EXSS, ECU—172 Minges Coliseum

FROM: UMCIRB

DATE: April 7, 2009

RE: Expedited Category Research Study

TITLE: "Reading During Exercise and its Impact on Affective State Responses"

UMCIRB #09-0330

This research study has undergone review and approval using expedited review on 4.4.09. This research study is eligible for review under an expedited category because it is on collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving x-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing. (Studies intended to evaluate the safety and effectiveness of the medical device are not generally eligible for expedited review, including studies of cleared medical devices for new indications.) Examples: (a) physical sensors that are applied either to the surface of the body or at a distance and do not involve input of significant amounts of energy into the subject or an invasion of the subject's privacy; (b) weighing or testing sensory acuity; (c) magnetic resonance imaging; (d) electrocardiography, electroencephalography, thermography, detection of naturally occurring radioactivity, electroretinography, ultrasound, diagnostic infrared imaging, doppler blood flow, and echocardiography; (e) moderate exercise, muscular strength testing, body composition assessment, and flexibility testing where appropriate given the age, weight, and health of the individual. It is also a research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3). This listing refers only to research that is not exempt.)

The Chairperson (or designee) deemed this **unfunded** study **no more than minimal risk** requiring a continuing review in **12 months**. Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The investigator must adhere to all reporting requirements for this study.

The above referenced research study has been given approval for the period of **4.4.09** to **4.3.10**. The approval includes the following items:

- Internal Processing Form (dated 3.25.09)
- Informed Consent (received 4.3.09)
- Par-Q & You
- Leisure Time Exercise Questionnaire

- Demographic Information
- Survey

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

The UMCIRB applies 45 CFR 46, Subparts A-D, to all research reviewed by the UMCIRB regardless of the funding source. 21 CFR 50 and 21 CFR 56 are applied to all research studies under the Food and Drug Administration regulation. The UMCIRB follows applicable International Conference on Harmonisation Good Clinical Practice guidelines.

APPENDIX C: PHYSICAL ACTIVITY READINESS QUESTIONNIARE

Physical Activity Readiness Questionnaire - PAR-Q (revised 1994)

PAR-Q & You

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: Check YES or NO

YES	NO		
❑	❑	1.	Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
❑	❑	2.	Do you feel pain in your chest when you do physical activity?
❑	❑	3.	In the past month, have you had chest pain when you were not doing physical activity?
❑	❑	4.	Do you lose your balance because of dizziness or do you ever lose consciousness?
❑	❑	5.	Do you have a bone or joint problem that could be made worse by a change in your physical activity?
❑	❑	6.	Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
❑	❑	7.	Do you know of any other reason why you should not do physical activity?

If you answered

YES to one or more questions

Talk to your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want—as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active—begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal—this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively.

Delay becoming much more active:

- if you are not feeling well because of a temporary illness such as a cold or a fever—wait until you feel better; or
- if you are or may be pregnant—talk to your doctor before you start becoming more active.

Please note: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

You are encouraged to copy the PAR-Q but only if you use the entire form

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.

NAME _____

SIGNATURE _____ DATE _____

SIGNATURE OF PARENT or GUARDIAN (for participants under the age of majority) _____ WITNESS _____

APPENDIX D: LEISURE TIME EXERCISE QUESTIONNAIRE

When answering this question, please:

- Only count exercise sessions that lasted 10 minutes or longer in duration
- Only count exercise that was done during free time (i.e., not occupation or housework)
- Note that the main difference between the three categories is the **intensity** of the exercise
- Please write the average frequency on the first line and the average duration on the second. If you did not perform any exercise at a given intensity, please write '0' in that space.

Recall your average weekly exercise (7 days). How many times, on average, have you performed the following kinds of exercise:

	Times Per Week	Average Duration
a. MILD EXERCISE (MINIMAL EFFORT, NO PERSPIRATION) (e.g., easy walking, yoga, bowling, lawn bowling, shuffleboard, golf)	_____	_____
b. MODERATE EXERCISE (NOT EXHAUSTING, LIGHT PERSPIRATION) (e.g., fast walking, tennis, easy bicycling, easy swimming, popular and folk dancing)	_____	_____
c. STRENUOUS EXERCISE (HEART BEATS RAPIDLY, SWEATING) (e.g., running, aerobics classes, cross country skiing, vigorous swimming, vigorous bicycling)	_____	_____

APPENDIX E: DEMOGRAPHIC FORM

Age _____ Gender (circle one): Male Female

Year in school ((circle one): First year Sophomore Junior Senior Other

Year in school _____ Major _____

What is your ethnic background? (Circle all that apply)

African American Asian Caucasian Hispanic Native American Other

APPENDIX F: EXERCISE INDUCED FEELING INVENTORY

Right now I feel: (Circle the appropriate number for each word)

	Do not feel	**Feel Slightly**	**Feel Moderately**	**Feel Strongly**	**Feel Very Strongly**
Refreshed	1	2	3	4	5
Calm	1	2	3	4	5
Fatigued	1	2	3	4	5
Enthusiastic	1	2	3	4	5
Relaxed	1	2	3	4	5
Energetic	1	2	3	4	5
Happy	1	2	3	4	5
Tired	1	2	3	4	5
Revived	1	2	3	4	5
Peaceful	1	2	3	4	5
Worn-out	1	2	3	4	5
Upbeat	1	2	3	4	5

APPENDIX G: FELT AROUSAL SCALE

Circle the number on each of the following items that best describes how you feel at the present moment

Low arousal	1	2	3	4	5	6	High arousal

APPENDIX H: FEELING SCALE

Please describe how you feel at this specific moment on the following scale.

Very good		**Good**		**Slightly Good**	**Neutral**	**Slightly Bad**		**Bad**		**Very Bad**
+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5

APPENDIX I: RATINGS OF PERCIEVED EXERTION

This scale is used to tell us how hard or easy you feel your workout is. Circle a number that best reflects how your total body felt in general during today's workout. Do not focus on a certain factor, like leg pain, chest tightness, or shortness of breath, but concentrate on a total body feeling. Be as accurate as you can when rating your level of exertion

Rating of Perceived Exertion Scale (RPE)

0	Nothing at all
0.5	Extremely Light
1	Very Light
2	Light
3	Moderate
4	Somewhat Heavy
5	Heavy
6	
7	Very Heavy
8	
9	
10	Extremely Heavy
•	*Maximal*

APPENDIX J: PHYSICAL ACTIVITY ENJOYMENT SCALE

Rate each of the following items based on the workout you just completed.

I enjoyed it	1	2	3	4	5	6	7	I hated it
I felt bored	1	2	3	4	5	6	7	I felt interested
I disliked it	1	2	3	4	5	6	7	I liked it
I found it pleasurable	1	2	3	4	5	6	7	I found it unpleasurable
I was very absorbed in the activity	1	2	3	4	5	6	7	I was not at all absorbed in the activity
It was no fun at all	1	2	3	4	5	6	7	It was a lot of fun
It was very pleasant	1	2	3	4	5	6	7	It was very unpleasant
I felt as though I would rather be doing something else	1	2	3	4	5	6	7	I felt as though there was nothing else I would rather be doing

APPENDIX K: MANIPULATION CHECK

MANIPULATION CHECK

	Not at all		**Some what**		**Very Much so**
I forgot about the stresses of life	1	2	3	4	5
Reading made the exercise session more fun	1	2	3	4	5
It was hard to focus on the reading while exercising	1	2	3	4	5
My mind kept thinking about all the things I need to get done for school	1	2	3	4	5
The book I read was engaging	1	2	3	4	5
I get a break from the demands of school	1	2	3	4	5
I enjoyed reading	1	2	3	4	5
Were you able to concentrate on the reading material?	1	2	3	4	5
I found the reading material pleasurable	1	2	3	4	5
I got so absorbed into the reading that time flew by while exercising	1	2	3	4	5
How understandable was the material you read?	1	2	3	4	5
I thought about things that are creating stress in my life	1	2	3	4	5
How often did your mind drift off while reading?	1	2	3	4	5
Exercise gave me mental break	1	2	3	4	5
It was hard to comprehend the reading material	1	2	3	4	5
I was totally absorbed into the reading	1	2	3	4	5

APPENDIX L: MANIPULATION CHECK ORGANIZED BY SUBSCALES

	Not at all		**Some what**		**Very Much so**
Distraction:					
I forgot about the stresses of life	1	2	3	4	5
I thought about things that are creating stress in my life	1	2	3	4	5
Exercise gave me mental break	1	2	3	4	5
I get a break from the demands of school	1	2	3	4	5
My mind kept thinking about all the things I need to get done for school	1	2	3	4	5
Absorption:					
I was totally absorbed into the reading	1	2	3	4	5
The book I read was engaging	1	2	3	4	5
I enjoyed reading	1	2	3	4	5
I found the reading material pleasurable	1	2	3	4	5
I got so absorbed into the reading that time flew by while exercising	1	2	3	4	5
Reading made the exercise session more fun	1	2	3	4	5
Focus:					
Were you able to concentrate on the reading material?	1	2	3	4	5
How often did your mind drift off while reading?	1	2	3	4	5
It was hard to focus on the reading while exercising	1	2	3	4	5
It was hard to comprehend the reading material	1	2	3	4	5
How understandable was the material you read?	1	2	3	4	5