I can usually handle whatever comes my way;" though it is not comprehensive, this attitude reflects Jerusalem and Schwarzer’s (1979) definition of the psychological construct of self-efficacy, one’s perception of how capable of success one is in specific situations. Such perceptions are highly malleable through mastery experience, modeling, verbal persuasion, and physiological states (Bandura, 1997). The plethora of research on self-efficacy initiated by Bandura has shown that self-efficacy significantly affects persistence and accuracy in mathematical tasks (Bandura & Schunk, 1981; Schunk, 1981) and may affect young people’s decisions about their futures (Betz & Hackett, 1981). Such findings solidify the importance of maintaining a high sense of self-efficacy across one’s life.

Self-efficacy is, in a sense, self-confidence in specific situations (Bandura, 1997). People anticipate outcomes of a situation dependent on how good they judge their performance will be in that situation. A young woman may have low exercising self-efficacy, for example, because she does not believe that she can run at a moderate intensity for 30 min. Yet the same young woman may have high academic self-efficacy because she is completely certain that she can maintain a 4.0 throughout her college career. One’s general self-efficacy, then, is the accumulation of all these perceptions of one’s abilities in specific situations. It is one’s judgment of one’s ability to accomplish goals and solve problems on a daily basis.

Self-efficacy is negatively correlated with psychological strain (Bandura, Cioffi, Taylor, & Brouillard, 1988; Jerome et al., 2002; Jex, Bliese, Buzzell, & Primeau, 2001). The ability to control cognitive demands reduces stress and mental strain and allows for normal cognitive functioning, and, according to Wiedenfeld et al. (1990), mastery of stressors strengthens one’s self-efficacy as well. In their study, Wiedenfeld et al. (1990) showed that as people with a phobia of snakes neared the day of the efficacy-acquisition phase, on which they would be expected to handle a snake, their stress levels rose significantly; but, as they gained experience in coping with the snake, their perceived self-efficacy increased. Cortisol levels were elevated at the beginning of each phase but declined as the sessions progressed, reaching their highest elevation in anticipation of the maximal-self-efficacy session. Once participants were fully efficacious, however, cortisol levels remained low, suggesting that mastery of stressors not only strengthens one’s sense of self-efficacy but also creates lasting changes that can protect against adverse immunological effects of stress.

The physiological effects of stress are measured easily, and research has found that exercise directly counteracts them. For example, King, Taylor, and Haskell (1993) found that their participants who were
assigned to an exercise group reported significantly lower stress during a 12-month period than those in the control group. Similarly, Chafin, Christenfeld, and Gerin (2008) found that exercising after stress accelerated cardiovascular recovery in undergraduate students. Although the blood pressures and heart rates of those in the stress/exercise group were more elevated immediately after the exercise session than those of the participants in the other conditions, 10 min later (after the recovery period), their blood pressures were significantly closer to baseline than those of the participants who did not exercise after stress.

Though exercise counteracts the physiological effects of stress, its benefits are modulated by individual and group factors such as gender and fitness. Among men between 20 and 30 years of age, for example, those who had been trained in an aerobic fitness program had significantly lower heart rates than those who were untrained. In addition, although all participants displayed marked elevations in heart rate and arousal at the onset of stress, the trained group had significantly lower anxiety scores post-stress and their heart rates returned to baseline much more rapidly than those who were untrained (Sinyor, Schwartz, Peronnet, Brisson, & Seraganian, 1983). A similar study (Wilfley & Kunce, 1986) revealed that exercise was much more beneficial to participants who were initially more stressed and had below-average fitness levels.

To determine whether exercise influences self-efficacy as it does stress, McAuley, Courneya, and Lettunich (1991) studied the effects of acute and long-term exercise on the perceived exercising self-efficacy of sedentary, middle-aged adults. Exercising self-efficacy was operationalized as the participant’s belief in his or her ability to exercise for a certain amount of time without stopping. Participants displayed lowered resting heart rate and increased aerobic capacity at the end of the 20-week exercise program. More importantly, all participants indicated they had significantly higher scores post-stress and their heart rates returned to baseline much more rapidly than those who were untrained (Sinyor, Schwartz, Peronnet, Brisson, & Seraganian, 1983). A similar study (Wilfley & Kunce, 1986) revealed that exercise was much more beneficial to participants who were initially more stressed and had below-average fitness levels.

While the aforementioned studies (McAuley et al., 1991; McAuley et al., 2005) have established a specific connection between exercise and increases in exercising self-efficacy, the effect of aerobic exercise on general self-efficacy is unexplored. This relationship would be particularly important for college students because of the finding that general self-efficacy can influence people’s decisions about their futures (Betz & Hackett, 1981).

Based on the findings of King et al. (1993) and McAuley et al. (1991), I hypothesized that long-term, aerobic exercise would increase the general and exercising self-efficacy of a sample of college students. Also, given Sinyor et al.’s (1983) results, I hypothesized that habitual exercisers would experience less of an increase in general and exercising self-efficacy following regular exercise than would nonhabitual exercisers. Finally, based on the findings of Wilfley and Kunce (1986), I predicted that less perceived stress would yield smaller increases in general and exercising self-efficacy.

Method

Participants
After receiving an email inviting them to participate in an exercise study, 27 undergraduates who were not currently college athletes agreed to work out for 2 weeks and then not to work out for 2 weeks as part of an experiment. Of the 18 students who successfully completed the 4-week study, 7 were men and 11 were women, and their ages ranged from 18 to 22 years. The 12 participants who were also psychology students received extra credit in their psychology courses, and, as additional incentive, the names of all participants who successfully completed the study were placed in a raffle for prizes of $25, $75, and $100 cash.

Materials
Workout log. Each participant was supplied a workout log on which to record the day of the workout, the type of workout he or she chose to do, and the length of the workout.

Self-efficacy measures. Participants filled out the 10-item General Self-Efficacy Scale (Jerusalem & Schwarzer, 1979). They rated on a 4-point scale their agreement with statements such as “I can always manage to solve difficult problems if I try hard enough” and “If someone opposes me, I can find the means and ways to get what I want.” General self-efficacy scores, then, ranged from 0 to 40, with higher scores indicating higher levels of general self-efficacy. The unidimensionality of the scale has been confirmed by studies in 14 countries (Schwarzer & Scholz, 2000). An exercising self-efficacy scale (Hu, Motl, McAuley, &
Konopack, 2007) measured how capable participants believed they were of completing 10, 20, 30, 40, 50, and 60 min of aerobic exercise at a moderate intensity. Participants rated how confident they were in their ability to successfully carry out the specified activity for each item on a scale from 0 to 100 presented in 10-point increments (a score of 100 meant they were 100 percent confident they could run for the specified amount of time).

**Stress measure.** Participants measured their stress using the 14-item Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). They rated how often in the last month they had experienced sensations such as being “upset because of something that happened unexpectedly” and feeling “that you were unable to control the important things in your life” on a scale ranging from 1 (*never*) to 5 (*very often*). Total scores ranged from 0 to 70, with higher scores indicating more perceived stress. This scale showed reliability as tested by Cohen, et al. (1983).

**Procedure**

Participants met in the intramural gym in order to receive oral instructions and to sign their consent forms. After being separated into two groups (habitual exercisers, who reported already working out more than three days in an average week, and nonhabitual exercisers, who reported not working out regularly), participants were randomly assigned to either Group A, whose participants would work out only during the first 2 weeks of the experiment (phase one), or to Group B, whose participants would work out only during the second 2 weeks of the experiment (phase two). The two phases of the experiment were implemented to control for stress induced by regular cycles of testing.

Working out consisted of walking, running, swimming, riding an exercise bike, or using an elliptical machine. Participants were told that the exercise needed to be continuous but it did not need to be 30 min at the same stress level (they were allowed to walk in-between periods of running, for example, but they were not allowed to stop walking). They were told to work out as long as they would like, but 30 min was the minimum for participation in the study. It was made clear that they were only to work out during the appropriate phase of the study. During nonactive weeks, they were not to engage in any physical activity geared toward becoming more physically fit. If they did or did not work out during the appropriate phase, however, they were asked to report honestly in their workout logs.

All participants were assured of the confidentiality of the study, informed of their right to stop participation at any time without penalty, and invited to ask questions. Participants then completed the Perceived Stress Scale, the General Self-Efficacy Scale, and an exercising self-efficacy scale; then the researcher thanked them for their participation. Thereafter, participants met with the researcher on either Monday or Tuesday of each week for the next 4 weeks to fill out the appropriate measures. They completed the general self-efficacy and exercising self-efficacy scales prior to beginning the experiment, after phase one, and after phase two. They completed the perceived stress scale prior to beginning the experiment and every week thereafter. Participants were debriefed upon completion of the month-long study.

**Results**

We calculated the general self-efficacy, exercise efficacy, and stress scores for each participant. After reverse-scoring the appropriate perceived stress items, we computed perceived stress and exercise efficacy scores by summing participant responses to the individual items of both measures. Exercise self-efficacy scores were based on 0 to 100 percent confidence; total scores were summed and then divided by 100 to obtain an average percent confidence score. On the general self-efficacy scales, responses of “not true at all,” “hardly true,” “moderately true,” and “exactly true” were assigned numbers of 1 through 4, respectively. Responses to all items were then summed to determine each participant’s general self-efficacy score, which ranged from 0 to 40. Final scores of each participant’s measures were then transformed into scores that would reflect the way in which participants’ general self-efficacy, exercising self-efficacy, and stress scores had changed over the course of the study. For those who had worked out during phase one of the experiment, their baseline general self-efficacy, exercising self-efficacy, and stress scores were subtracted from their general self-efficacy, exercising self-efficacy, and stress scores after 2 weeks of exercise. For those who had exercised during phase two of the experiment, their general self-efficacy, exercising self-efficacy, and stress scores after 2 weeks of not working out were subtracted from their general self-efficacy, exercising self-efficacy, and stress scores after 2 weeks of exercise.

Change scores were analyzed using a two-way mixed model ANOVA, the two independent variables being type of exerciser (habitual or nonhabitual) and phase of exercise (exercising or not exercising), with repeated measures on the phase of exercise variable. As suggested in Figure 1, general self-efficacy was significantly affected by phase of exercise, $F(1,14) = 7.05, p = .017$, partial $\eta^2 = .306$, meaning that general
Self-efficacy scores of both habitual and nonhabitual exercisers increased significantly when working out for 2 weeks ($M = 1.78, SD = 2.46$) as compared to their scores when not allowed to work out for 2 weeks ($M = -1.11, SD = 3.03$). Type of exerciser also had a significant impact on general self-efficacy scores, $F(1, 14) = 4.50, p = .05, \eta^2 = .219$, in that nonhabitual exercisers reported more positive change in general self-efficacy regardless of phase of exercise.

The data presented in Figure 1 also show a similar and significant effect of exercising on participants’ exercising self-efficacy, $F(1,14) = 7.27, p = .016$, partial $\eta^2 = .312$. Specifically, exercising self-efficacy scores increased by a mean of 5.00 ($SD = 6.15$) during participants’ 2 weeks of working out; while not working out, they remained relatively stable, changing only by a mean of 0.94 ($SD = 7.67$). Type of exerciser did not significantly affect exercising self-efficacy, although this effect did approach significance, $F(1,14) = 4.10, p = .06$, partial $\eta^2 = .204$.

As indicated by Figure 2, exercise also significantly affected perceived stress scores, $F(1,14) = 6.20, p = .024$, partial $\eta^2 = .280$, while type of exerciser did not. Participants reported an average 7.78 decrease ($SD = 9.42$) in stress when working out and an average increase of 2.17 ($SD = 9.97$) in stress when not allowed to work out.

Finally, to determine if less stress predicted smaller increases in general or exercising self-efficacy, participants with moderate stress scores (between 52 and 62) were removed from the sample and the remaining participant scores were divided into two groups: low stress (those with scores between 36 and 51) and high stress (those with scores between 63 and 78), resulting in 6 participants in each group. The mean increase in general self-efficacy and exercising self-efficacy was compared using independent samples $t$ tests. Findings were not significant for general self-efficacy nor for exercising self-efficacy, indicating that level of stress did not have an impact on level of self-efficacy.

**Discussion**

The present study showed that aerobic exercise significantly increased the general self-efficacy of college students, regardless of their exercise history. That is, after 2 weeks of engaging in at least 30 min of aerobic exercise three times a week, participants reported significantly higher levels of general self-efficacy than they reported either at baseline or after 2 weeks of not exercising. However, when separated by type of exerciser, nonhabitual exercisers reported significantly more positive changes in general self-efficacy than did habitual exercisers. Participants also reported higher levels of exercising self-efficacy, as well significantly lower levels of perceived stress, than they did after 2 weeks of not exercising. Finally, level of perceived stress did not appear to have a significant impact on general or exercising self-efficacy.

The unique finding of the present study was the effect of aerobic exercise on the general, rather than exercising, self-efficacy of college students. Previous research (McAuley et al., 1991; McAuley et al., 2005) testing the effects of exercise on self-efficacy has focused solely on exercising self-efficacy. Thus, the finding of an increase in general self-efficacy is distinct.
Not surprisingly, nonhabitual exercisers reported essentially no change in general self-efficacy when not exercising. Their reports of general self-efficacy increased, however, when working out. Congruent with previous research (Willfle & Kunce, 1986), this effect was significantly more pronounced in nonhabitual versus habitual exercisers. Habitual exercisers reported significantly less positive changes in general self-efficacy than did nonhabitual exercisers. Though their general self-efficacy increased when exercising, the general self-efficacy of habitual exercisers decreased significantly when they were not allowed to exercise for 2 weeks.

The finding that habitual exercisers were more affected by lack of exercise than were nonhabitual exercisers makes sense because not exercising violates part of a habitual exerciser’s weekly routine. It is possible that these exercisers were intrinsically motivated to work out on a regular basis and that when not allowed to work out the lack of exercise negatively affected their psychological well-being.

Both groups of exercisers reported higher levels of exercising self-efficacy after 2 weeks of exercise as compared to baseline and after 2 weeks of nonexercise, as suggested by previous research (McAuley et al., 1991; McAuley et al., 2005). Among habitual exercisers, exercising efficacy increased while working out and decreased while not exercising. Interestingly enough, however, nonhabitual exercisers reported an increase in exercising efficacy even when they were not exercising. Though only marginally significant, this difference between groups is quite apparent in Figure 1 and should be further explored in a similar study with more participants.

Given previous data (Chafin et al., 2008; King et al., 1993; Willfle & Kunce, 1986), I expected that exercise would significantly decrease participants’ perceived stress. It was surprising, though, that level of stress was not affected by an increase in either general or exercising self-efficacy. Perhaps a larger sample size would have revealed the expected relationships. It is important to note that the present study included a sample of only 18 participants because 9 of the 27 participants either dropped out or did not complete the experiment as instructed. Although the groups were divided fairly evenly (7 men, 11 women; 8 habitual exercisers, 10 nonhabitual exercisers), the small sample size may account for the lack of significant effects for level of stress.

The current study leaves several aspects of the relationship between exercise and self-efficacy unexplored. Future research could explore the exercise/self-efficacy relationship among athlete and nonathlete students. Athletes were not included in the present study because their enforced intensive exercise may either make them immune to, or make them react especially strongly to, 2 weeks of not exercising. Also, despite 30 years of active research, gender differences in general self-efficacy are poorly understood. Because gender differences have not been well-defined by previous research, gender differences in general and exercising self-efficacy need further clarification. Finally, the finding that not exercising impacts the general self-efficacy of habitual exercisers has not been reported before and, therefore, warrants exploration. The general self-efficacy of habitual exercisers drops considerably when they are not exercising (see Figure 1). Future research might investigate the relationship between general self-efficacy and self-esteem (or, more specifically, self-esteem variability) and the way in which exercise affects the combination. It may be that people with more stable self-esteem will be less affected by exercise than those with more variable self-esteem (Kernis, 2005).

Regardless of limitations, the present study yielded findings that have important implications for the lives of college students. General self-efficacy significantly affects performance on a variety of tasks (Bandura & Schunk, 1981; Schunk, 1981) and may affect students’ decisions about their life goals (Betz & Hackett, 1981). The knowledge that exercise can build one’s beliefs in one’s abilities should challenge young people to re-evaluate their lifestyles and to incorporate exercise into their lives.

References


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