EFFECTS OF SHORT-TERM GOAL-SETTING ON ENJOYMENT AND SESSION RATINGS OF PERCEIVED EXERTION DURING A ROWING TASK

by

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ABSTRACT

The aim of the current study was to explore the effects of short-term goal-setting on enjoyment and session ratings of perceived exertion during a rowing exercise task. Because of the rising rates of obesity in the United States (Hales et al., 2020) and the effectiveness of physical activity in managing a healthy weight and enhancing quality of life (U.S. Department of Health and Human Services, 2018), the question of how to increase physical activity levels of individuals is of high importance. If greater adherence to exercise programs is effective in weight management and positive physical and mental health outcomes (U.S. Department of Health and Human Services, 2018), and enhanced enjoyment is associated with greater exercise adherence (Hartmann et al., 2015), understanding how to increase enjoyment during exercise could help individuals to enhance physical activity levels and health. Short-term goal-setting and its effects on exercise enjoyment has not yet received adequate attention in the literature, and the current study set out to fill in this gap by testing the effects of short-term goal-setting on ratings of enjoyment using the Physical Activity Enjoyment Scale (PACES) and session ratings of perceived exertion using the Borg Scale during an exercise bout on the Aviron Tough Series Rower. Twenty-five physically active individuals were recruited for participation in this study and completed two exercise sessions on separate occasions under a repeated measures design. Each participant completed one session under the experimental condition and one session under the control condition. The experimental session included use of a pacer on the rower screen during two separate rowing bouts, which served as a goal-setting simulation. The control session did not use this pacer during the two separate rowing bouts. In both conditions during the break between the first and second bout, participants set a goal for the distance that they would row in the second bout. At the end of each session, participants completed the PACES, Borg Scale, and Commitment Check. Paired sample t-tests were analyzed for PACES, sRPE, distance, and heart rate (HR). Significance between conditions were analyzed at a p value of $< .05$. Results showed non-significant differences between conditions for enjoyment, sRPE, HR, and distance rowed. There was, however, a significant difference found for distance rowed from exercise bout one to exercise bout two in both the experimental condition and the control condition. While the use of the pacer as a short-term goal-setting intervention was not effective in significantly increasing enjoyment, the use of self-chosen short-term goals as set during the break should be studied further in future research to determine their effectiveness in enhancing performance and enjoyment in exercise. It should also be considered motivating for exercisers and practitioners that intricate pacers or goal-setting tools may not be necessary for enhancing exercise outcomes, and that instead simply reflecting on past performance and setting self-chosen goals may be adequate for improving exercise effectiveness.

Effects Of Short-term Goal-Setting on Enjoyment and Session Ratings of Perceived Exertion During a Rowing Task

Physical inactivity is a major national health concern, with less than 5% of adults participating in 30 minutes of physical activity each day in the United States (U.S. Department of Health and Human Services, 2018). In 2018, the Centers for Disease Control (CDC) reported that 42.4% of adults in the US were obese and 9.2% of adults were severely obese (Hales et al., 2020). Physical activity is an effective strategy to manage a healthy weight, reducing risk of cardiovascular disease and all-cause mortality, and improving quality of life (U.S. Department of Health and Human Services, 2018). Enhanced adherence to physical activity programs in more adults could therefore reduce the prevalence of obesity in the United States through weight management and improve quality of life. Even in those who are not struggling with excess weight or obesity, greater rates of physical activity could provide benefits in physical outcomes, including improved sleep and improved bone health, and mental health outcomes, including reduced risk of anxiety, depression, and dementia (U.S. Department of Health and Human Services, 2018).

Considering the vast benefits of greater adherence to exercise mentioned above, it is important to consider how to increase adherence. Goal-setting and enjoyment are key components in the adherence to any exercise program. Goal-setting has been associated with positive physical activity outcomes, which include increased levels of physical activity (Lewis et al., 2016), increased adherence to exercise programs (Hartmann et al., 2015), and improved performance (Burke et al., 2010). Goal-setting has additionally been associated with improved cognitive outcomes (Gerani et al., 2020). These include increased motivation (Vidic & Burton, 2010), satisfaction, confidence, interest, and enjoyment (Trenz & Zusho, 2011). Current studies have examined the relationship between goal-setting and long-term exercise interventions;

however, more research is needed to understand the effect of short-term goal-setting on individual exercise sessions (Coppack et al., 2012; Gu et al., 2018; Saajanaho et al., 2014; Trenz & Zusho, 2011; Wilson & Brookfield, 2009). Long-term goals refer to those that are continuously relevant to multiple training sessions over a period of time, while short-term goals refer to those that are relevant only to a single exercise session. In order to improve mental and physical health in the general population, exercise must be enjoyable enough for individuals to adhere to a program long-term (Vella et al., 2017). If short-term goal-setting can help to improve the level of enjoyment, individuals will see an increase in mental and physical health, including better performance, greater effort, enhanced cognitive function, and increased motivation.

The following literature review explains past research, exploring topics relevant to the current study. It encompasses associations between goal-setting and other health-related factors. Main findings include relationships between goal-setting and: (1) motivation and adherence (Wilson & Brookfield, 2009), (2) self-efficacy (Coppack et al., 2012), and (3) exercise activity level (Saajanaho et al., 2014). Because researchers also measure enjoyment as a primary outcome, factors associated with enjoyment are also worth exploring. Research shows that exercise enjoyment is associated with enhanced adherence (Jekauc, 2015; Vella et al., 2017) and that exercise mode preference is also related to enhanced adherence (Thum et al., 2017). A second factor being explored is ratings of perceived exertion (RPE). Research has shown that goal-setting is related with higher RPE values (Swann et al., 2020), specifically when goals are higher (Anson & Madras, 2015) and attentional demand is increased (Radel et al., 2017). Reviewing this literature provides a foundation for the necessity of the present study, as it explores relevant health-related factors and applies them to short-term rather than long-term goal-setting.

The purpose of the current study was to examine the effectiveness of short-term goal-setting on exercise enjoyment, perceived exertion, and performance. It was hypothesized that short-term goal-setting would increase enjoyment during an exercise session compared to a control group. Perceived exertion was studied as an exploratory variable, as the literature review demonstrated some instances of increases in perceived exertion with goal-setting, but logistically it was considered that goal-setting could provide a distraction from effort being exerted and thus reduce ratings of perceived exertion. If results show that short-term goal-setting has an effect on enjoyment and/or performance, then individuals may have a practical reason to incorporate goal-setting in their individual exercise sessions. This will provide them with superior results compared to sessions where goal-setting is not used.

Literature Review

Three main themes that have been explored in previous research are the relationship between enjoyment and exercise, the relationship between goal-setting, motivation and adherence to an exercise program, and the relationship between the perceived exertion, effort and goal-setting or motivation. Past research supports the effectiveness of goal-setting in exercise and its influence on various cognitive and physical outcomes (Anson & Madras, 2015; Brownsberger et al., 2013; Burner & Spink, 2011; Coppack et al., 2012; Graupensperger et al., 2019; Gu et al., 2018; Hawkins et al., 2020; Jekauc, 2015; Radel et al., 2017; Saajanaho et al., 2014; Swann et al., 2020; Thum et al., 2017; Trenz & Zusho, 2011; Vella et al., 2017; Wilson & Brookfield, 2009). However, when reviewing this research, it is essential to note that most of the studies have evaluated long-term goal-setting while neglecting to mention any potential short-term goal-setting benefits. This literature review assesses past research into long-term goal-setting in order to draw conclusions on the benefits of short-term goal-setting in exercise and validate the utility of our study. Goal-setting has been shown to be related to motivation and adherence to exercise programs (Wilson & Brookfield, 2009). Enjoyment has also been shown to be associated with exercising adherence (Graupensperger et al., 2019) and is evaluated as a subscale of motivation within the Intrinsic Motivation Inventory (Wilson & Brookfield, 2009). Research has also demonstrated that goal-setting is related to the effort expended during exercise (Anson & Madras, 2015). The following sections will examine the research in more detail.

Goal-Setting, Motivation and Exercise Adherence

Weinberg (2013) refers to the term “goal” in goal-setting studies as attaining a specific level of proficiency on a task, usually within a specified time limit. Research has shown that goal-setting can be an effective strategy for increasing motivation and adherence to exercise (Coppack et al., 2012; Gu et al., 2018; Saajanaho et al., 2014; Trenz & Zusho, 2011; Wilson & Brookfield, 2009). Adherence and consistency are important components to any exercise program. Being consistent with an exercise regimen allows individuals to achieve maximal results, and being motivated to continue showing up to and pushing themselves through every exercise session can influence consistency.

Past research has used study designs with multiple levels of a goal-setting independent variable to assess various cognitive dependent variables. These independent variable levels often include different types of goals (outcome vs process) compared to a control condition. Process goals are focused on what you are doing and how your body is behaving during an exercise session, while outcome goals are focused on the results achieved after the session or across many sessions. More specifically, Wilson and Brookfield (2009) examined the effects of outcome and process goals on motivation and adherence to exercise in a six-week intervention compared to a control group. Recreational exercisers were split into three different groups: a process goal group, an outcome goal group, and a control (no goal) group. Process goals set included “maintain your heart rate” and outcome goals set included “lose four kilograms in six weeks.” There was no formal goal-setting done in the control group. They found that both the process goals and outcome goals groups scored significantly higher on subscales of the Intrinsic Motivation Inventory and had significantly greater adherence compared to a control group.

Another study used a pedometer-based intervention with physical education students to evaluate the effects of two experimental goal-setting groups, one with personalized step goals and the other with fixed step goals, and a control group with no step goals (Gu et al., 2018). Expectancy-value beliefs, motor competence, and physical activity levels were measured for all groups. They found that both experimental groups had significantly higher expectancy-value beliefs (an individual's expectations for succeeding), motor competence (based on gymnastics and soccer skills), and physical activity levels (based on steps taken per class) after the intervention compared to control groups. This demonstrates the effect of goal-setting in these areas.

Furthermore, Coppack et al. (2012) randomly assigned participants to a goal-setting group or one of two control groups. The goal-setting experimental group actively set goals and compared their progress to their goal throughout the study, adjusting their goals as needed. The first control group was led by a therapist who provided verbal encouragement, while the second control group was led by a therapist who did not provide verbal encouragement. The use of these two control groups removed social support as an uncontrolled variable influencing adherence. This strategy allowed them to examine the effects of goal-setting on self-efficacy, treatment efficacy, treatment outcomes, and adherence in a lower back pain rehabilitation setting. They found that self-efficacy and adherence to the rehabilitation program were significantly greater in the goal-setting group compared to the control groups, with no significant difference found for treatment outcomes.

Other research designs do not necessarily manipulate goal-setting but instead measure an individual's tendency to set goals based on perceptions of their environment or personal desires and then evaluate outcomes. Trenz and Zusho (2011) examined the relationships between competitive swimmers' perceptions of the motivational climate on their team, their personal achievement goals, and their satisfaction, persistence, and practice avoidance in swimming through a series of questionnaires. Motivational climates are generated by a coach and made salient to an athlete through conducting practices, providing feedback and evaluation, helping set goals, and providing social support. Perceptions of mastery-oriented motivational climates (those that are focused on positive outcomes such as social interactions, work ethic, learning, and participation) were positively related to mastery-approach goals (when an individual is focused on mastering a task for their own competence) and performance-approach goals (when an individual is focused on outperforming others) and satisfaction with swimming and negatively related to practice avoidance (the extent to which an individual resists exerting effort in a practice situation). Saajanaho et al. (2014) evaluated the relationship between the prevalence of personal goals related to exercise and physical activity levels in older women after an 8-year follow up. Participants who had initially reported personal goals related to exercise (using Brian R. Little's Personal Project Analysis) at baseline were more than three times as likely to be active in exercising at the 8-year follow up compared to those who did not have such goals. Other types of personal goals were not associated with continued exercise activity at the follow up. This indicates the importance of exercise-related personal goals for long term adherence and health benefits

Enjoyment and Exercise Adherence

Enjoyment is a component of exercise that is essential for an individual to adhere to an exercise program. Exercise enjoyment occurs when an individual shows positive responses to movement and experiences pleasure from the activity (Baldwin et al., 2016). Enjoyment during exercise can improve motivation and adherence; therefore, if goal-setting can enhance enjoyment, it will also strengthen these same characteristics. This could enhance motivation, increase cognitive function, and positively impact mental and physical health. Previous research has demonstrated the robust relationship between enjoyment and long-term adherence to an exercise program. However, additional research is needed to determine whether enjoyment and short-term goal-setting can increase motivation within individual exercise sessions and yield the same benefits.

A research study analyzing 17 overweight adults compared adherence, enjoyment, and cardiometabolic measures among each participant (Vella et al., 2017). Participants were randomly placed into a high-intensity interval training (HIIT) or a moderate-intensity continuous training (MICT) group. Researchers told each participant to complete their exercises thirty minutes, four times a week for five weeks independently, after a twelve-session supervised session. Using the physical activity enjoyment scale, researchers assessed participants' enjoyment levels after the third exercise session of each week. Results indicated that HIIT was more enjoyable among the population and had higher unsupervised adherence rates. These results demonstrate that when one enjoys the exercise they are completing, there is an increased likelihood of adhering to the program even without supervision. Comparably, a study hypothesized that HIIT leads to increased enjoyment levels compared to moderate-intensity continuous training (MICT). Researchers evaluated twelve active adults performing either HIIT (eight 1 min bouts of cycling at 85% maximal workload [Wmax]) or MICT (20 min of cycling at 45% Wmax) in a randomized order (Thum et al., 2017). Scores from the Physical Activity Enjoyment Scale (PACES) indicated a notable difference in enjoyment between MICT and HIIT and confirmed that 92% of participants had a higher enjoyment for HIIT training. These studies demonstrate a link between preferred exercise mode and adherence to exercising.

Furthermore, Jekauc (2015) investigated the association between affective states and exercise and whether the association could improve exercise adherence. Personal trainers in the control group used the American College of Sports Medicine (ACSM) training principles, and the experimental group focused on enjoyment rather than following strict guidelines. Affective states were measured using the PACES before session one, at the end of session four, and at the end of the last session. Results indicated that affective states during exercise influence one's ability to adhere to physical activity. This study, along with other research, strengthens the argument that increased affective states and enjoyment can increase physical activity adherence.

Goal-Setting and Rating of Perceived Exertion (RPE)

Increasing the use of goal-setting in an exercise program will also enhance one's mental and physical effort (Swann et al., 2020). Therefore, one relationship worth exploring is the effect of goal-setting on ratings of perceived exertion (RPE) and performance. The Borg Scale for RPE measures a participant’s subjective assessment of exercise intensity, or how hard the participant feels the task was (Borg, 1982; Swann et al., 2020). Previous research has examined RPE as a variable in the goal-setting studies, and the effect goal-setting has on perceived effort. But the plausibility of goal-setting increasing perceived exertion or perceived effort is unknown.

More specifically, Swann et al. (2020) compared the effects of different goal-setting interventions on RPE and exercised enjoyment during a six-minute walking test. The goal-setting interventions consisted of open goals, SMART goals, “do-your-best” goals, and a control condition. SMART goals refer to goals that are specific, measurable, achievable, realistic/relevant and time-bound. All experimental conditions had a significantly higher RPE than the control group. Therefore, RPE can be higher when there is a goal-setting intervention versus no goal, implying that individuals put more effort into the exercise activity when they have a goal. The same result is observed in a study by Hawkins and colleagues (2020), where the design was very similar, but the participants included both active and inactive adults. These articles support the assumption that goal-setting can increase RPE, even across different populations.

Looking further into the effects of goal-setting interventions, Anson and Madras (2015) studied the impact of lower goals versus higher goals on effort and performance in walking through the use of pedometers. This study was based on the assertion that higher goals lead to more significant effort and better performance. The groups given a goal of 5,000 hit an average of 7,500 steps daily, and the groups with a goal of 10,000 hit an average of 9,000 steps daily. These results included the groups that switched conditions half-way through. Even though the groups with a higher goal did not hit their goal on average, the steps are significantly greater than the lower goal groups' steps. These results support the claim that higher goals result in greater effort and better performance, whereas lower goals result in lower effort and performance.

Moreover, Radel et al. (2017) investigated the effects of attentional focus and RPE in response to anticipation of prolonged exercise. In the experimental condition, participants cycled on the ergometer for 60 minutes. The exercise was stopped after ten minutes (the same duration as the control), and the participants were told that enough data was collected. The participants were less focused on the exercise trial when told their exercise session would last 60 minutes versus the ten-minute task. Their reactions demonstrate that they were conserving mental effort. RPE was not statistically significant between conditions; however, there was a higher RPE associated with a higher focus on the task. This indicates that depending on the goals set, one's RPE can increase or decrease based on their anticipation of the level of intensity. Along similar lines, Brownsberger and colleagues (2013) examined the effects of mental fatigue on performance during exercise bouts. One condition was the control, where participants had two 10-minute bouts on the cycle ergometer, one with an RPE of 11 and the other at 15, using Borg's 6-20 scale. The experimental condition induced mental fatigue by requiring the participants to complete a continuous cognitive activity for 90 minutes prior to the same two exercise bouts. As expected, the power output for the experimental condition was significantly lower than in the control condition. RPE may be influenced by both mental and physical fatigue, which can both be important components of an exercise task, indicating the importance of studying RPE in an exercise intervention.

Conclusion

The impact of goal-setting on adherence and motivation, enjoyment, RPE, and performance are vital themes present within the current study. After examining previous research, there is evidence demonstrating that goal-setting can increase motivation, thus increasing adherence to an exercise program. Another relationship noted is that goal-setting has the possibility of enhancing enjoyment during exercise. The notion that goal-setting can increase effort may point to the plausibility of goal-setting increasing RPE, as well. However, these assumptions are mostly based on long-term goal interventions. There is a clear gap where there is little to no research done on short-term goal-setting interventions and exercise programs, leading to the purpose of the current study.

Method

Participants

Twenty-five participants, ages 18-23 (mean age 20.8, SD = 1.04) including 19 females and 6 males were recruited from a university in south central U.S. to participate in this study. Each participant confirmed that they meet the 150 minutes of moderate intensity or 75 minutes of vigorous intensity weekly exercise recommended by the American College of Sports Medicine (Riebe et al., 2018). Participants were excluded from the study if they were under 18 years old, did not meet the required amount of weekly physical activity, or unable to perform the rowing task. Each individual was required to sign a consent form indicating they understand the risks involved with their participation prior to beginning the trial.

Task conditions

The study included two conditions: a control group and experimental group. All participants completed both conditions. For the control condition, the participant rowed for a total of four minutes with a five second break after the first 2 minutes using the “metrics monitor” setting on the rower screen. Using this setting, the screen displayed distance in meters rowed, power in watts, pace, calories burned, strokes and strokes per minute, heart rate, and elapsed time. For the experimental condition, participants rowed four minutes total split into two laps of two minutes each with a five second break in between them using the “lightning lap” setting on the rower screen. Using this setting, the screen displayed a spaceship which moved around an oval shaped track at a speed matched to the speed that the participant is rowing for two minutes. After the two minutes had elapsed, another space ship appeared next to the previous space ship that was used. For the next two minutes, the previous spaceship imitated the speed of the previous lap that was completed, while the new spaceship simultaneously moved at a speed matched to the participant's current rowing speed. The old space ship served as a pacer, and by rowing faster than the pacer, the participant would cover more distance during the two minute bout. Participants were instructed to try to beat their previous speed and distance rowed each lap, simulating a goal setting intervention.

Instrumentation

Informed Consent. This form explained the study's procedures, the risks and benefits, participants' right to withdrawal at any time, and ensured the confidentiality of the information collected throughout the study.

Demographic Information. Participants answered a variety of demographic questions regarding age, gender, race, and year in college.

International Physical Activity Questionnaire. This scale was used to ensure that participants were getting 150 minutes of moderate physical activity or 75 minutes of vigorous physical activity weekly.

Task-Specific Motivation Scale. This scale was used to ensure that participants felt confident in their physical ability to perform the task adequately and motivated to perform well.

Session Ratings of Perceived Exertion (sRPE). The Borg Scale was used to address session ratings of perceived exertion, which indicates the level of effort a participant subjectively feels that they put into the exercise session. sRPE is scored on a 10-point scale ranging from 0 (nothing at all) to 10 (maximal). The greater the sRPE score, the greater the rating of perceived exertion and subjective effort was for that participant during the exercise session. The scale was shown to have high intratest (r = .93) and retest (r = .83-.94) reliabilities and high correlation with other measures of exertion including lactic acid, heart rate, peak oxygen uptake, and ventilation (Borg, 1998).

The Physical Activity Enjoyment Scale (PACES). This scale was used to address ratings of enjoyment during the session. It contains 18 statements such as “I enjoy it”, “I feel bored”, and “I feel physically good while doing it” which the participants rated their agreement or disagreement with the statements.

The Commitment Check. This was used to ensure that participants were committed to the exercise task, were able to tolerate physical discomfort during the task, and felt that they put effort into completing the task.

Procedure

Before the study began, IRB approval was confirmed. All participants were asked to participate voluntarily in this study. Participants were tested individually during their specific time-block to reduce the possible social facilitation effect. Before they participated, participants underwent a COVID-19 symptom screening. From there, they were asked to read and sign the informed consent indicating that they were aware of the risks involved with completion of the exercise task. They also completed the demographic questionnaire and International Physical Activity Questionnaire (see appendices) to ensure that participants were obtaining the minimum number of minutes of weekly exercise. Next, participants’ height and weight were collected and participants were fitted with a Polar H10 heart rate monitor. This monitor was placed around the sternum directly on the skin under the participant’s clothes. The monitor was held in place and secured with an elastic chest strap. Resting heart rate was collected for 2 minutes. Then, participants were familiarized with the Aviron Tough Series rower which was utilized for all testing. After familiarization, participants completed the Task-Specific Motivation Scale (see appendix). Following a randomized crossover design, participants completed their first exercise task under either the experimental condition or a control condition during their first session. The exercise session consisted of rowing for a specified amount of time on the Aviron Tough Series Rower. For both conditions, participants warmed-up and cooled-down on the rower for 3-minutes. For the control condition, participants rowed for a total of four minutes with a five second break after the first 2 minutes using the “metrics monitor” setting on the rower screen (see appendix). For the experimental condition, participants rowed for four minutes total, split into two laps of two minutes each with a five second break in between them using the “lightning lap” setting on the rower screen (see appendix). Participants were instructed to try to beat their previous speed and distance rowed each lap, simulating a goal setting intervention. Distance rowed during the time interval was measured by the Aviron Tough Series Rower. After completing their first round in either condition, the participant rested for 5 minutes and then was asked to set a goal for distance rowed in a second trial. Following the rest period, participants completed the same condition again as described above following the rest period on the same day. The participants' heart rate was collected upon completion of the exercise task, which was considered the post-exercise heart rate. Participants then completed the sRPE scale, the PACES and the commitment check. Participants were debriefed after the session and explained not to discuss the study with any potential participants. Participants who completed the first session under the control condition completed the second session under the experimental condition, and vice versa 48 hours later. The participation took about 30 minutes on two separate occasions, for a total of 60 minutes.

Statistical Analyses

Descriptive statistics were used to analyze the demographic information. Paired sample t-tests were analyzed for PACES, sRPE, distance, and HR. This allowed us to compare the experimental condition to the control condition on all three variables and evaluate significant differences between groups, at a p value of $< .05$. SPSS version 26 was used to analyze the data.

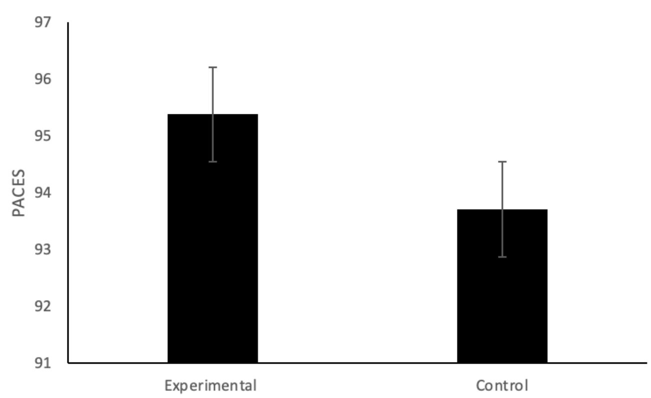
Results

PACES

A paired-sample t-test was calculated to compare the mean perceived enjoyment in the experimental condition compared to mean perceived enjoyment in the control condition. The mean in the experimental condition was 95.38 (*SD* = 18.51) and the mean in the control condition was 93.71 (*SD* = 16.47). A non-significant difference was found between the two conditions (t (23) = -.749, $p > .05$; see figure 1).

Figure 1

Mean PACES score by condition.

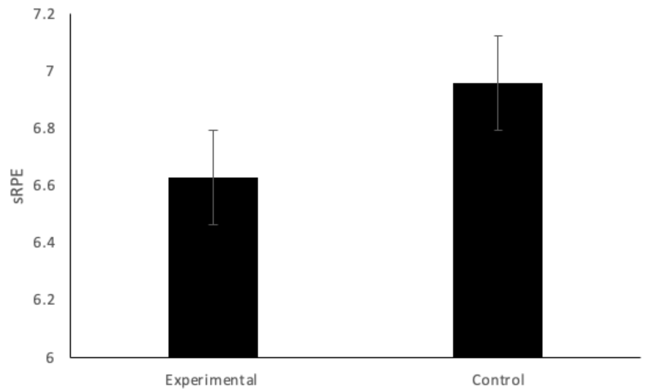


sRPE

A paired-sample t-test was calculated to compare the session rating of perceived exertion in the experimental condition compared to session rating of perceived exertion in the control condition. The mean in the experimental condition was 6.63 (*SD* = 1.69) and the mean in the control condition was 6.96 (*SD* = 1.60). A non-significant difference was found between the two conditions (t (23) = .984, $p > .05$; see figure 2).

Figure 2

Mean sRPE score by condition

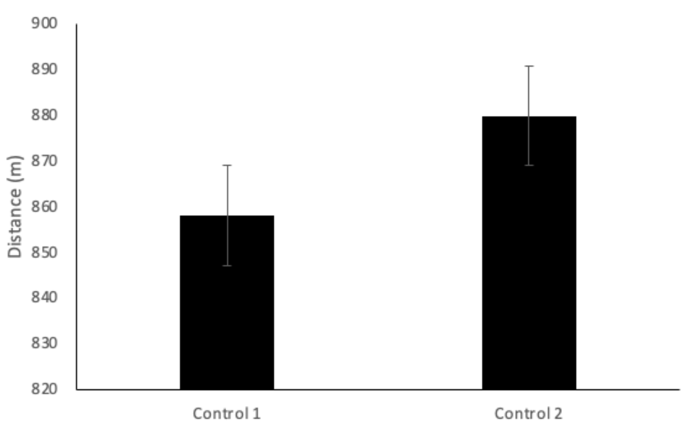


Distance Rowed: Control condition trial 1 vs trial 2

A paired-sample t-test was calculated to compare the distance rowed in the first bout of the control condition compared to distance in the second bout of the control condition. The mean in the first bout was 858.13 (*SD* = 82.11) and the mean in the second bout was 879.92 (*SD* = 89.20). A significant difference was found between the two conditions (t (23) = 3.587, $p < .05$; see figure 3).

Figure 3

Mean distance rowed in control condition bouts

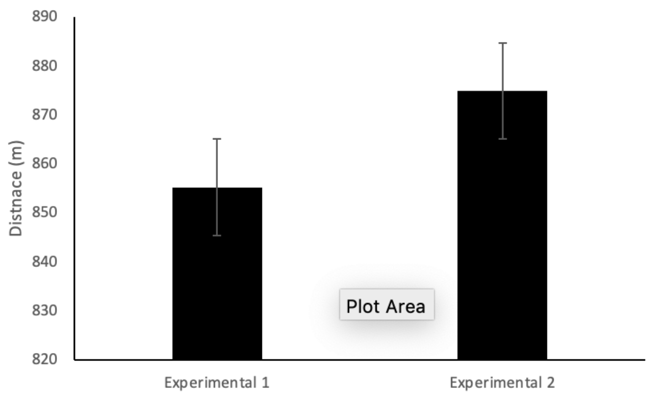


Distance Rowed: Experimental condition trial 1 vs trial 2

A paired-samples t-test was calculated to compare the distance rowed in the first bout of the experimental condition to distance in the second bout of the experimental condition. The mean in the first bout was 855.21 (*SD* = 98.38) and the mean in the second bout was 874.88 (*SD* = 99.03). A significant difference was found between the two conditions (t (23) = 2.323, $p < .05$; see figure 4).

Figure 4

Mean distance rowed in experimental condition trials

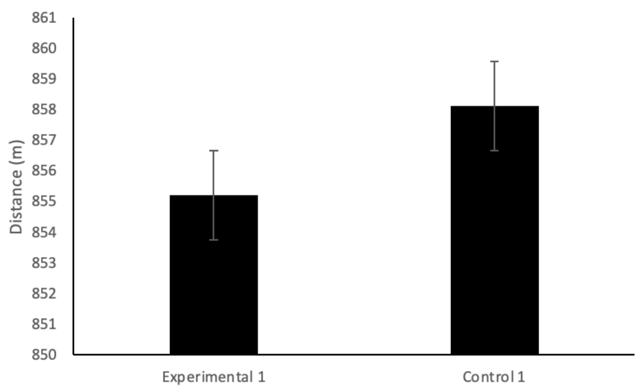


Distance Rowed: Experimental condition trial 1 vs control condition trial 1

A paired-sample t-test was calculated to compare the distance rowed in the first bout of the experimental condition compared to distance rowed in the first bout of the control condition. The mean in the first bout of the experimental condition was 855.21 (*SD* = 98.38) and the mean in the first bout of the control condition was 858.13 (*SD* = 82.11). A non-significant difference was found between the two conditions (t (23) = .310, $p > .05$; see figure 5).

Figure 5

Mean distance rowed in experimental condition trial 1 and control condition trial 1

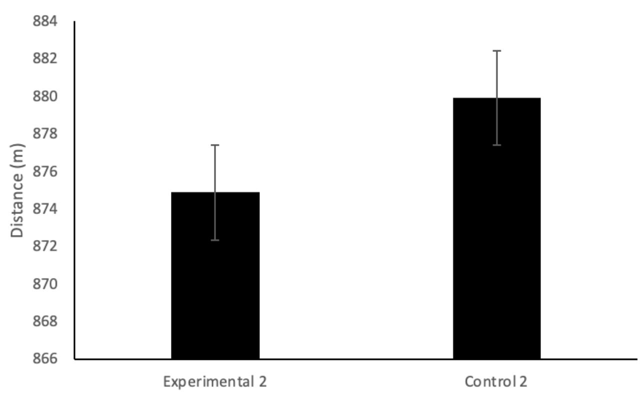


Distance Rowed: Experimental condition trial 2 vs control condition trial 2

A paired-sample t-test was calculated to compare the distance rowed in the second bout of the experimental condition compared to distance rowed in the second bout of the control condition. The mean in the second bout of the experimental condition was 874.88 (*SD* = 99.03) and the mean in the second bout of the control condition was 879.92 (*SD* = 89.20). A non-significant difference was found between the two conditions (t (23) = .637, p > .05; see figure 6).

Figure 6

Mean distance rowed in experimental condition trial 2 and control condition trial 2

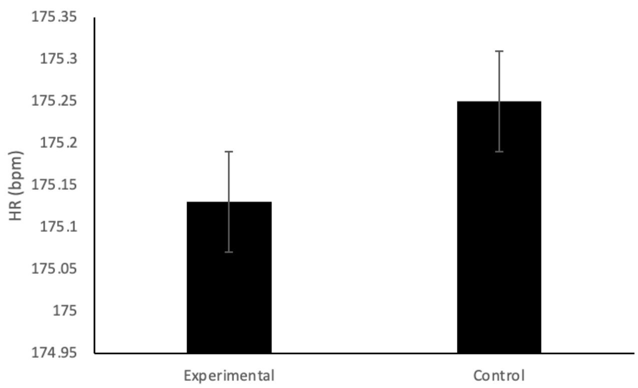


Post-Exercise Heart Rate

A paired-sample t-test was calculated to compare the mean post-exercise heart rate in the experimental condition compared to mean post-exercise heart rate in the control condition. The mean in the experimental condition was 175.13 (SD = 14.28) and the mean in the control condition was 175.25 (SD = 11.79). A non-significant difference was found between the two conditions (t (23) = .043, $p > .05$; see figure 7).

Figure 7

Mean post-exercise heart rate in experimental condition and control condition



Frequency of Meeting Goal

Descriptive analysis was used to compare the frequency of meeting the goal set in the experimental condition compared to the experimental condition. In the experimental condition, 11 individuals met their goal (45.8%) while 13 individuals did not meet their goal (54.2%). In the control condition, 14 individuals met their goal (58.3%) while 10 individuals did not meet their goal (41.7%).

Discussion

The purpose of this study was to evaluate the outcomes of short-term goal-setting in rowing exercise tasks regarding levels of enjoyment, session ratings of perceived exertion, and rowing distance. This was achieved by comparing outcomes in an experimental and a control condition for each participant using a repeated measures design. The experimental condition utilized a pacer setting using the "lightning lap" screen on the rowing machine in order to simulate short-term goal-setting. The control condition did not include this pacer setting, instead displaying a simple "metrics monitor" screen. During each of the two sessions in the lab, participants rowed two bouts of four minutes each, with a five-minute break in between the two. During this break, they were asked to set a goal for the distance that they would row in the second bout.

In contradiction to our hypotheses, a non-significant difference was found for enjoyment during the experimental compared to control condition, which was measured using the PACES scale. This indicates that the utilization of the pacer during the exercise task did not significantly increase enjoyment of the participants. There was also a non-significant difference found between the distance rowed from exercise bout one in the experimental condition and exercise bout one in the control condition, or between exercise bout two in the experimental condition and exercise bout two in the control condition. This demonstrates that the pacer used to simulate short-term goal-setting during each exercise bout did not produce a significant difference in performance compared to the control condition without the pacer. The discrepancy between these findings and those found in previous literature exploring the effects of long-term goal-setting and enjoyment and performance may be due to an innate difference in the effectiveness of short-term goals compared to long-term, or the specific type of goal used in this study- the pacer setting. Wilson and Brookfield (2009) found that both process and outcome goals caused significantly higher scores on subscales of the Intrinsic Motivation Inventory compared to a control group in a long-term exercise intervention. Our use of the pacer most closely aligns with a short-term outcome goal, as the goal is to beat the pacer at the end of the exercise bout, instead of a focus on the rowing technique used during the exercise task. This could suggest the possibility of a greater efficacy of process goals compared to outcome goals in short-term goal-setting in order to enhance enjoyment, and these differences should be considered for future research.

Interestingly, there was a significant difference found between the distance rowed from exercise bout one to exercise bout two in the experimental condition and control condition. This indicates that there may be an effect of short-term goal-setting on performance in exercise, which can be attributed to the goal set during the five-minute break between exercise bouts. Though we can't establish a causal relationship because this goal-setting activity was present in all conditions, this is a novel way to study short-term goal-setting and should be considered for future research. If a causal relationship can be established, then exercise participants should consider setting goals between exercise bouts in order to enhance their performance. This may also provide information about the types of goals being set and their effectiveness- specifically self-chosen goals compared to use of a pacer. This may be motivating for exercisers, as a complex pacer or intricate setting may not be necessary in order to enhance performance. It may be the case that simply reflecting on previous performance and setting a goal for yourself is effective enough to improve performance. Gu et al (2018) found that personalized step goals significantly increased physical activity levels (steps taken per class) compared to a control group. These findings are consistent with the significant difference in distance rowed after setting a goal during the break found in the current study. The distance goal that each participant set was personalized to them and their previous performance, similar to the personalized step goals. Another interesting finding was that it did not actually matter whether the participants met their goal or not, evidenced by the qualitative analysis of the frequency of meeting goals above. In the experimental condition, 45.8% of participants met their goal, and 58.3% of participants met their goal in the control condition. Even with only about half of participants meeting the goals set, the significant difference in distance rowed from bout one to bout two still existed in both conditions.

A non-significant difference was found for session ratings of perceived exertion in the experimental compared to control conditions. This indicates that participants subjectively felt that they were exerting a similar amount of effort during both conditions. There was also a non-significant difference found for post-exercise heart rate in the experimental compared to control conditions. This indicates that there was also an objective similarity in physical exertion in the participants across conditions. These results are consistent with Borg's (1998) evaluation of the validity and reliability of the scale, in which it was found that RPE and HR were correlated and therefore provided a valid measure of subjective effort. Further, Radel et al. (2017) described an association between higher RPE and higher attentional focus on the task. The distracting stimuli of the experimental condition in the current study could potentially have reduced the participant's focus on the task itself. In turn, this reduced attentional focus could have caused the non-significant correlation between the experimental condition and lower sRPE scores.

Limitations and future research

The current study has various limitations that could be addressed in future studies. First, our study limited our research to college students who were considered "active" as characterized by the

International Physical Activity Questionnaire. Therefore, the generalizability of the study is only to this group. Future research should examine individuals who are sedentary and low-active. Secondly, participants were solely assessed on their rowing performance and only were assessed on two occasions under varying conditions. Future research in this field should consider using a training study with multiple days and activities in order to produce more data for each participant. Additionally, gender ratio inequalities can cause variability in results, as it is possible that goal-setting impacts females differently than males. In this case, our study examining a disproportionate number of females could have adverse effects on generalizability across genders. Future research should utilize a more expansive list of participants with equal gender ratios or manipulate conditions to compare effects between genders in order to address potential differences. The use of masks due to COVID-19 safety protocols may have also limited the performance ability and comfort of the participants. Future research should find safe ways to ensure comfort during the exercise task. The current study employed the goal-setting between exercise bouts in all conditions. In order to determine a causal relationship between the goal setting during the break and greater distance rowed in the subsequent exercise bout, future studies should include a condition without the goal setting during the break as a control for data comparison. Because the visual and audio stimuli on the "lightning lap" screen during the experimental condition may have been distracting to participants and limited their ability to row faster, a less stimulating pacer may be considered for future use. Future studies may also benefit from a pacer that can be set to go faster than the first lap, instead of matching the time of the first lap. Because the ability to clearly view distance rowed in meters on the "metric monitor" setting may have enabled participants to better reach their goal, future research should consider removing this ability through blocking part of the screen.

Conclusions

The data presented indicate that our hypothesis regarding the use of a pacer to simulate short-term goal-setting in order to enhance enjoyment was not supported. The sRPE also showed no difference across conditions. The most noteworthy outcome was the significant difference in distance rowed between the two exercise bouts in each condition, which may be attributed to the use of goal-setting during the break, when each participant established their own goal for their upcoming performance. Further research should be done using a similar design, but including a condition without the use of goal-setting during the break, to determine differences between goal-setting and improved performance. Exercise participants should be aware of the potential plausibility of self-directed goals, and the usefulness of exercise for improved health outcomes in general (U.S Department of Health and Human Services, 2018). Practitioners should also be aware of the utility of incorporating short-term goal-setting into sessions with patients or athletes, and encouraged by the fact that complex instruments and machines are not necessary to elevate the quality and successes of their practice.

References

Anson, D. and Madras, D. (2015). Do low step count goals inhibit walking behavior: a randomized controlled study. *Clinical Rehabilitation, 30*(7). doi: 10.1177/0269215515593782

American College of Sports Medicine, Riebe, D., Ehrman, J. K., Liguori, G., & Magal, M. (2018). *ACSM's guidelines for exercise testing and prescription* (Tenth edition.). Philadelphia: Wolters Kluwer.

Aviron Interactive Inc. (2020). Aviron Tough Series Rower. Toronto, ON, Canada.

Baldwin, D. R., Datta, S., Bassett, D. R., Overstreet, B. S., & Schweighart, P. (2016). Feel better but exercise less: An examination of exercise enjoyment, personality and physical activity in young adults. *Acta Psychopathologica*, *2*(1), 1-7.

Brownsberger, J., Edwards, A., Crowther, R., and Cottrell, D. (2013). Impact of mental fatigue on self-paced exercise. *International Journal of Sports Medicine, 34*(1029-1036). http://dx.doi.org/ 10.1055/s-0033-1343402.

Borg, G.A. (1982). Psychophysical bases of perceived exertion. *Medicine and Science Sports Exercise*, 14, 377–381.

Borg, G. (1998). *Borg's perceived exertion and pain scales.* Champaign, IL: Human Kinetics.

Burke, S. M., Shapcott, K. M., Carron, A. V., Bradshaw, M. H., & Estabrooks, P. A. (2010). Group goal setting and group performance in a physical activity context. *International Journal of Sport and Exercise Psychology*, 8(3), 245–261. https://doi-org.ezproxy.tcu.edu/10.1080/1612197X.2010.9671952

Coppack, R. J., Kristensen, J., & Karageorghis, C. I. (2012). Use of a goal setting intervention to increase adherence to low back pain rehabilitation: a randomized controlled trial. *Clinical Rehabilitation*, *26*(11), 1032–1042.

Gerani, C., Theodosiou, A., Barkoukis, V., Papacharisis, V., Tsorbatzoudis, H., & Gioupsani, A. (2020). The Effect of a Goal-Setting Program in Physical Education on Cognitive and Affective Outcomes of the Lesson. *Physical Educator*, 77(2), 332–356.

Graupensperger, S., Gottschall, J. S., Benson, A. J., Eys, M., Hastings, B., & Evans, M. B. (2019). Perceptions of groupness during fitness classes positively predict recalled perceptions of exertion, enjoyment, and affective valence: An intensive longitudinal investigation. *Sport, Exercise, and Performance Psychology*, *8*(3), 290.

Gu, X., Chen, Y.-L., Jackson, A. W., & Zhang, T. (2018). Impact of a pedometer-based goal-setting intervention on children's motivation, motor competence, and physical activity in physical education. *Physical Education & Sport Pedagogy*, 23(1), 54–65.

Hales, C., Carroll, M., Fryar, C., Ogden, C. (2020). *Prevalence of obesity and severe obesity among adults: United States, 2017–2018*. NCHS Data Brief, no 360. Hyattsville, MD: National Center for Health Statistics. https://www.cdc.gov/nchs/products/databriefs/db360.htm

Hartmann, C., Dohle, S., & Siegrist, M. (2015). A self-determination theory approach to adults' healthy body weight motivation: A longitudinal study focussing on food choices and recreational physical activity. *Psychology & Health*, 30(8), 924–948.

Hawkins, R., Crust, L., Swann, C., and Jackman, P. (2020). The effects of goal types on psychological outcomes in active and insufficiently active adults in a walking task: further evidence for open goals. *Psychology of Sport and Exercise, 48*. https://doi.org/10.1016/j.psychsport.2020.101661

Jekauc, D. (2015). Enjoyment during exercise mediates the effects of an intervention on exercise adherence. *Psychology*, *6*(01), 48.

Lewis, L. K., Rowlands, A. V., Gardiner, P. A., Standage, M., English, C., & Olds, T. (2016). Small steps: Preliminary effectiveness and feasibility of an incremental goal-setting intervention to reduce sitting time in older adults. *Maturitas*, 85, 64–70. https://doi-org.ezproxy.tcu.edu/10.1016/j.maturitas.2015.12.014

Radel, R., Brisswalter, J., and Perrey, S. (2017). Saving mental effort to maintain physical effort: a shift of activity within the prefrontal cortex in anticipation of prolonged exercise. *Cognitive, Affective, and Behavioral Neuroscience, 17*(305-314). DOI 10.3758/s13415-016-0480-x

Saajanaho, M., Viljanen, A., Read, S., Rantakokko, M., Tsai, L.-T., Kaprio, J., Jylhä, M., & Rantanen, T. (2014). Older Women's Personal Goals and Exercise Activity: An 8-Year Follow-Up. *Journal of Aging & Physical Activity*, *22*(3), 386–392.

Swann, C., Hooper, A., Schweickle, M., Peoples, G., Mullan, J., Hutto, D., Allen, M., and Vella,

S. (2020). Comparing the effects of goal types in a walking session with healthy adults: Preliminary evidence for open goals in physical activity. *Psychology of Sport and Exercise,47.* https://doi.org/10.1016/j.psychsport.2019.01.003

Thum, J. S., Parsons, G., Whittle, T., & Astorino, T. A. (2017). High-intensity interval training elicits higher enjoyment than moderate intensity continuous exercise. *PloS one*, *12*(1), e0166299.

Trenz, R. C., & Zusho, A. (2011). Competitive swimmers' perception of motivational climate and their personal achievement goals. *International Journal of Sports Science &Coaching*, 6(3), 433–443. https://doi-org.ezproxy.tcu.edu/10.1260/1747-9541.6.3.433

U.S. Department of Health and Human Services (2018). *Physical Activity Guidelines for Americans, 2nd edition* (p 32). Washington D.C: U.S. Department of Health and Human Services.

Vella, C. A., Taylor, K., & Drummer, D. (2017). High-intensity interval and moderate-intensity continuous training elicit similar enjoyment and adherence levels in overweight and obese adults. *European Journal of Sport Science*, *17*(9), 1203-1211

Vidic, Z., & Burton, D. (2010). The Roadmap: Examining the Impact of a Systematic Goal-Setting Program for Collegiate Women's Tennis Players. *Sport Psychologist*, 24(4), 427–447.

Weinberg, Robert. (2013). Goal setting in sport and exercise: Research and practical applications. *Revista da Educação Física* / UEM. 24. 171-179. 10.4025/reveducfis.v24.2.17524.

Wilson, K., & Brookfield, D. (2009). Effect of goal setting on motivation and adherence in a six-week exercise program. *International Journal of Sport and Exercise Psychology*, 7(1), 89–100. https://doi-org.ezproxy.tcu.edu/10.1080/1612197X.2009.9671894