

Benchmark Experimental Proposal Assignment

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I have no known conflict of interest to disclose.

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Abstract

Research has demonstrated that grit can be developed in individuals. It is hypothesized that the incorporation of a grit curriculum into the training of high school cross country runners, and adherence to the curriculum, will improve five-kilometer time trial results of participants, at the completion of a cross-country season, more than the final time trial results of a control group that does not receive, or adhere to, the grit curriculum training. The proposed research will show that runners who participate in and adhere to the grit curriculum training will demonstrate statistically greater improvement in final time trial results than the control group.

Keywords: grit, grit curriculum, running, endurance, cross country

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Cross country running is an endurance sport that requires participants to develop stamina, perseverance, and a passion for long-term goals, which align with the definition of grit provided by Duckworth et al. (2007). The research in this proposal will consider whether grit can be taught and developed, as well as whether such a curriculum could be incorporated into a high school cross-country running program and increase running performance during a standard cross-country competitive season.

Literature Review

Duckworth et al. (2007) define grit as a non-cognitive trait that is composed of the subunits of perseverance and passion for long-term goals. Though Duckworth et al. (2007) conducted their research in the United States, the definition of grit is not isolated to a specific group or region. Lechner et al. (2019) examined the distribution of grit among adults in Germany, as well as within the context of socioeconomic subgroups, and found that the meaning of grit was consistent among the socioeconomic groups identified (age, gender, education, and employment status). In addition to providing a definition of grit, Duckworth et al. (2007) sought to provide a means with which to measure the non-cognitive trait in their research.

To quantify grit, Duckworth et al. (2007) developed a 12-item scale (Grit-O) in which the items are categorized by consistency of interest and perseverance of effort. However, the researchers noted that the scale could be developed further (Duckworth et al., 2007). As a result, Duckworth and Quinn (2009) developed the Short Grit Scale (Grit-S), which is an eight-item scale, and administered the scale in six separate studies. Duckworth and Quinn (2009) concluded that the Grit-S scale was a more efficient method with which to measure trait-level perseverance, as well as passion in the pursuit of long-term goals. Since the publication of the study by

Duckworth et al. (2007), grit has been studied within a variety of domains, such as academics, military, athletics, mental health, and addiction.

In the academic domain, Tang et al. (2019) studied the influence of grit on academic achievement and engagement in a study of Finnish secondary school students and found a positive correlation between grit and increased engagement as well as academic achievement. In the athletic domain, Pettersen et al. (2020) noted higher Grit-S scale scores in endurance athletes (cross-country skiers and long-distance runners) compared to soccer players and non-athletes. Furthermore, A study by Calo et al. (2024) suggests that a combined approach of interventions meant to increase resilience, grit, and growth mindset can reduce stress in health profession students and increase overall sense of well-being. Which begs the question of whether grit can be taught.

Some studies have concluded that grit is malleable. In a longitudinal survey of 60 Virginia Military Institute college students, Whipple and Dimitrova-Grajzl (2024) examined the development of grit over the course of four years and determined that grit can change over time and can be modified by practices such as goal commitment and deliberate practice. Wang et al. (2023) used a quasi-experimentally designed study of 864 Chinese middle school students, of whom 201 were the control group, to examine the effects of a grit training course in the reduction of school bullying and noted a negative correlation between Grit-S scale scores with bullying and being bullied. The authors also noted a decline in bullying behavior during the grit training program (Wang et al., 2023).

Since research supporting the hypothesis that grit can be taught exists, what effect would a grit curriculum have on participants in a study focused on athletic performance? The purpose of this research is to determine if the administration of a grit curriculum would improve athletic

performance. Specifically, it is hypothesized that a cross-country training program augmented with a grit curriculum will improve the five-kilometer time trial performance of high school cross country runners during a typical three-month season, compared to the performance gains achieved through a traditional cross-country training program.

Method

Participants and Procedure

A convenience sample of 30 high school students who are members of the varsity cross-country team of school district in New York State (15 males, 15 females) will participate in a pretest-posttest control group design study. After consent for research participation from parents and athletes, as well as school districts, are received, each athlete will be randomly assigned to either the treatment group (Group 1) or the control group (Group 2).

Prior to the study, the grit curriculum will be provided to the team coaches in the form of a video recording, produced by the research team, so that the administration of the training will remain consistent. Participants will complete the Grit-O scale (Duckworth et al., 2007), prior to the administration of the grit curriculum. The independent variable of the study is treatment (grit curriculum) versus no treatment (control group). The dependent variable will be participants' adherence to the grit curriculum throughout the study. At the end of the season and study, participants will complete the Grit-O scale to determine whether the grit curriculum had an effect on participants in the treatment group.

In addition, each participant will complete a five-kilometer time trial (the study covariate), administered by coaching staff, at the commencement of the summer cross-country training program, on the home course of the participating high school prior to the administration of the grit curriculum. The grit curriculum will be administered from the start of the summer

training schedule until the end of the competitive cross-country season to Group 1 participants via the grit curriculum video recording supplied to the coaches by the research team. Team coaches will provide Group 1 with grit curriculum video training sessions after each practice and document each session's participants and topics covered. The training sessions will be administered to Group 1 until the end of the cross-country season. Upon completion of the competitive season, participants will complete the Grit-O scale and run a five-kilometer time trial administered and recorded by the coaching staff. The data collected before and at the conclusion of the study will be analyzed.

Covariates of the study could include incoming time trial results, diffusion of treatment, and training age. Diffusion of treatment could occur should participants assigned to Group 1 share what they learn with Group 2 and is a potential threat to the internal validity of the study (Heppner et al., 2015). A potential mitigation measure would be for the coach of the team to emphasize discretion among participants. Another covariate that may affect the results of the study is the training age of participants. Training age denotes the cumulative running experience and training load of each participant, which could affect the overall change in performance. The internal validity of the study could be threatened as well by sample attrition. In sample attrition, participants could leave the study before its completion, such as a cross-country runner quitting the team or sustaining an injury that would preclude the runner from participating in the remainder of the season. Another covariate that should be considered is changes in weather. High school cross-country training begins in mid-August in New York State. The competitive season begins in September and ends in November. New York State can experience significant fluctuations in temperature and precipitation which can affect running performance. Mantzios et al. (2022) note that athletic performance can be adversely affected by temperature, relative

humidity, wind speed, and solar radiation, of which none can be controlled in cross-country running.

Measurement

Duckworth et al. (2007) developed a 12-item scale (Grit-O) in which the items are categorized by consistency of interest and perseverance of effort. Within the Grit-O scale, the six questions pertaining to consistency of interest and the six perseverance of effort questions use a five-point Likert scale, which begins with 1 = *not at all like me* and culminates with 5 = *very much like me* (Duckworth et al., 2007). Participants can receive a maximum score of 5 (extremely gritty) and a minimum score of 1 (not at all gritty) (Duckworth et al., 2007). Duckworth et al. (2007) observed high internal consistency ($\alpha = .85$) for the Grit-O scale. Study participants will complete the Grit-O scale at the beginning of the study, as well as at the completion of the study.

At the beginning of the study, participants will engage in a time trial in which they will run five kilometers on the home course of the participants' school. The time trial results will be measured by coaching staff using a stopwatch and recorded in minutes and seconds. The participants will complete a second time trial at the completion of the cross-country season using the same method of measurement and data recording. Each time trial will be conducted on the home course of the participants' high school to ensure consistency.

Data Analysis

To determine whether a grit curriculum will create a statistically significant difference on participants' five-kilometer time trial results compared with those of the control group, analysis of covariance (ANCOVA) will be used to analyze the collected data since ANCOVA can accommodate one or more covariates, unlike analysis of variates (ANOVA) (Heppner et al.,

2015). In this study, ANCOVA will be used to control covariates statistically, which will enhance the accurate assessment of the relationship between Grit-O scores, baseline time trial times, the final time trial times, and participants' adherence to the grit curriculum. The baseline time trial times will be covariates since each athlete will have unique results. The individual differences in times can impact the outcome of the study and could obscure the impact of the grit curriculum. Introduction of baseline time trial times and initial Grit-O scores can facilitate a more accurate analysis of the impact of adherence to a grit curriculum on cross country running performance over time (effect size). The baseline times will then be compared with the final time trial times to determine statistical significance (non-zero effect).

During the data analysis process, caution must be exercised to mitigate the potential for Type I and Type II errors. In the proposed study, an example Type I error would occur if the null hypothesis (a grit curriculum makes no difference in final time trial results) was rejected when the results confirm that the grit curriculum did not impact final time trial results (Heppner et al., 2015). An example of a Type II error would happen if the null hypothesis was accepted when the results show that the grit curriculum impacted the final time trial results, and the null hypothesis should be rejected. Since the sample size of the proposed study is relatively small, indicating low power, the potential for a Type II error increases. However, if the effect size is large, the power could be considered acceptable. The potential for a Type II error in this study may require a less stringent significance level.

Conclusion

While research has demonstrated that the noncognitive quality of grit can be developed in individuals, the purpose of this proposed research is to investigate whether the implementation of, as well as adherence to, a grit curriculum would improve the five-kilometer time trial times of

a convenience sample of high school cross-country runners within a competitive season. While the proposed experiment could illuminate the potential for grit to be taught and incorporated into the training regimen of high school cross-country runners, future research possibilities exist in which that potential could be examined further. The grit curriculum could be incorporated at various athletic levels, in addition to high school, such as collegiate and professional. The grit curriculum could also be tested within the paradigms of different endurance sports, such as ultrarunning or triathlon.

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