Continuation/Research Progression Projects Form (7)

Required for projects that are a continuation/progression in the same field of study as a previous project.

This form must be accompanied by the previous year's abstract and Research Plan/Project Summary.

Student's Name(s) Ankit Sayed

To be completed by Student Researcher: List all components of the current project that make it new and different from previous research. The information must be on the form; use an additional form for previous year and earlier projects.

Components	Current Research Project	Previous Research Project: Year: 2019
1. Title	Analyzing Long-Term Improvement in Adolescent Cross-Country Performance	Determining the effect of various weather conditions on adolescent cross-country performance
2. Change in goal/ purpose/objective	Instead of studying weather patterns and their effect on running, this project is studying the general improvement in running performance	Only studied weather patterns over the course of a single season.
3. Changes in methodology	A much larger pool of runners across multiple teams that was tracked for four seasons, using multiple statistical tests.	Did not use extensive statistical testing and was limited to one team over the course of one season.
4. Variable studied	Running improvement, in terms of personal record time	The exact times the runners ran in the season.
5. Additional changes		

Attached are:

☑ Abstract and Research Plan/Project Summary, Year 2020

I hereby certify that the above information is correct and that the current year Abstract & Certification and project display board properly reflect work done only in the current year.

Ankit Sayed	Ankit Sayed Digitally signed by Ankit Sayed Date: 2020.01.28 16:50:44 -05'00'	1/28/2020
Student's Printed Name(s)	Signature	Date of Signature (mm/dd/yy)

OFFICIAL ABSTRACT and CERTIFICATION

Determining the Relationship Between Adolescent Cross Country Performance and Weather Condition

Ankit Sayed

W. Tresper Clarke High School, Westbury, NY, USA, 11590

Weather conditions are considered instrumental by many runners to achieving faster times. However, few studies have been conducted regarding athletics and weather conditions, especially not WBGT (Wet Bulb Globe Temperature), which measures heat stress on the environment. This value incorporates temperature, humidity, and wind speed into one quantitative value. In this study, race times were collected from six meets from the W.T. Clarke Boys Cross Country team's 2017 season. Times were averaged out to form a linear regression for team performance throughout the season.. Weather conditions were obtained from the closest weather station to the race course. Race times were graphed against each weather condition, and linear regressions were taken for each value, with r-squared values being used to assess correlation. The team ' s race times decreased as the season went on, with a negative slope supported by a significant r-squared value of 0.66. This means that the team, as expected, became faster after gaining experience and training time. When it came to weather, temperature seemed to have the most prominent correlation. The linear regression of race times vs. temperatures had a positive slope and a significant r-squared value of 0.51. However, the highest r-squared value for weather was that of WBGT, with a value of 0.53, which was higher than the value for heat index, 0.47. This supports the replacement of heat index and other isolated measurements by WBGT as the comprehensive value for determining labor and athletic conditions.

Category
Pick one only—
mark an "X" in
box at right

- Animal Sciences ☐
- Behavioral and Social Science ☐
- Biochemistry ☐
- Cellular & Molecular Biology ☐
- Chemistry ☐
- Computer Science ☐
- Earth Science ☑
- Eng: Electrical & Mechanical ☐
- Eng: Materials & Bioengineering ☐
- Energy & Transportation ☐
- Environmental Management ☐
- Environmental Sciences ☐
- Mathematical Sciences ☐
- Medicine and Health ☐
- Microbiology ☐
- Plant Sciences ☐
- Physics and Astronomy ☐

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):

   ☐ human subjects ☐ potentially hazardous biological agents
   ☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue

2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only ☒ Yes ☐ No

3. I/we worked or used equipment in a regulated research institution or industrial setting: ☐ Yes ☒ No

4. This project is a continuation of previous research. ☐ Yes ☒ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☒ No

6. I/we hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work. ☒ Yes ☐ No

This stamp or embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Scientific Review Committee.

COMPLETING THE ABSTRACT:
Abstracts are limited to a maximum 250 words and must fit within the predefined area. Please be sure to consult the information from your affiliate fair for the proper formatting of the header information as fairs differ in what is required (or not allowed).
The abstract **should include the following:**
a) *purpose of the experiment*
b) *procedure*
c) *data*
d) *conclusions*

It may also include any possible research applications. Only minimal reference to previous work may be included. An abstract **must not include the following**:
a) *acknowledgments (including naming the research institution and/or mentor with which you were working), or self-promotions and external endorsements*
b) *work or procedures done by the mentor*

COMPLETING THE CERTIFICATION:
At the bottom of the Abstract & Certification form there are six questions. Read each carefully and answer appropriately. The Affiliated Fair Scientific Research Committee will review and approve the abstract and answers to the questions.

Please bring a copy of your Abstract & Certification to the fair and be sure to consult with your affiliated fair regarding the rules of making copies to distribute.

TIPS ON WRITING A PROJECT ABSTRACT
A project abstract is a brief paragraph or two (limited to 250 words or 1,800 characters) highlighting and/or summarizing the major points or most important ideas about your project. An abstract allows judges to quickly determine the nature and scope of a project.
- Emphasize these aspects: purpose (hypothesis), methods (procedures used), data summary or analysis, and conclusions.
- Focus only on the current year's research.
- Omit details and discussions.
- Use the past tense when describing what was done. However, where appropriate use active verbs rather than passive verbs.
- Use short sentences, but vary sentence structure.
- Use complete sentences. Don't abbreviate by omitting articles or other small words in order to save space.
- Avoid jargon and use appropriate scientific language.
- Use concise syntax, correct spelling, grammar, and punctuation.

AVOID A REWRITE
- Focus on what you did, not on the work of your mentor or of the laboratory in which you did your work.
- Do NOT include acknowledgements, self promotion or external endorsements. Don't name the research institution and/or mentor with which you were working and avoid mentioning awards or honors (including achieving a patent) in the body of the abstract.
- Be sure to emphasize the current year's research. A continuation project should only make a brief mention of previous years' research (no more than a sentence or two).

Research Plan

Ankit Sayed

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Determining the Relationship Between Adolescent Cross Country Performance and Weather Conditions

Acknowledgments:

I thank Dr. Jase Bernhardt from Hofstra University for his assistance with obtaining and interpreting weather data as well as Coach Brian Doxey of the W.T. Clarke Boys Cross Country Team for his assistance clarifying meet schedules and the times of his runners.

Introduction:

Cross-country has been a high school sport for many years. In the sport, participants race for long distances, anywhere between four thousand to eight thousand meters. High school cross country primarily takes place in the fall season, between the months of August and November. The timeframe can cause fluctuation in weather conditions, which many athletes and coaches believe has an impact on athletic performance (Voltaire 2002). The effect of weather conditions on running performance has several factors. As athletes exert themselves, they build up heat within their bodies. Excess internal heat inhibits athletes from performing well, as brain signals resulting from excess heat have effects with are not conducive to running, such as vasodilation and increased sweating, which are both used to cool down the body (Kenefick 2007). Sweat cools the body by evaporation, and this is affected by both the air temperature and humidity. Temperatures exceeding 35℃ or humidities higher than 60% may cause extreme fatigue and/or dehydration in runners who are exerting themselves for an extremely long time, such as a marathon (Nielsen 1996). This is due to the internal core temperature reaching a value of about 40℃, causing internal organs and core muscles to become less efficient (Tegeder 2006).

Heat buildup's negative impact on athletic performance can be supported by the practice of precooling. Athletes who seek to minimize heat buildup may cool their bodies through ice baths or other methods before exercise. This has been shown to increase the time necessary for a cross-country runner to reach their peak core temperature, allowing them to exercise longer

(Tegeder 2006). This may also support the idea that cooler temperatures can lead to increased performance for endurance running, as they would have a similar effect as precooling would.

This study will seek to answer the question of weather possibly having an impact on cross-country racing times in adolescents. This group has been understudied when it comes to exercise. While there is an abundance of information about thermoregulation and weather conditions affecting adult running performance, there is a lack of adolescent information. Almost all studies on adolescent running focus on training methods, not weather impact (Rumpf 2012). However, knowledge on this topic would greatly benefit high school cross country teams, as devoting training time to weather acclimatization has possible benefits for a running team (Voltaire 2002).

Materials and Methods:

The two types of data used will be running data and weather data. The running data used will be taken from the W. Tresper Clarke Boys Cross Country team 2017-18 season. This is publicly available from online Nassau County Section VIII Cross Country records. Each runner on the team is listed, as well as their times for the meets that they ran. The dates and estimated start times for each race are listed as well. For the purposes of the study, only 5K(2.5 miles) races will be taken into account and runners who had under four 5K meets in the season will be removed. Runners who ran too few meets would have too much inconsistency in their progress and would not be able to produce accurate results.

The weather data used will be obtained from NOAA National Environmental Satellite Data and Information Service as well as the Iowa State University Environmental Mesonet. Both sources were publicly available on the internet. The data being used for each meet date and time

will include the average temperature, dewpoint, relative humidity, visibility, and wind speed. The National Weather Service Wet Bulb Globe Temperature calculator was used to determine the WBGT as well as the heat index, which evaluates the weather conditions in relation to physical exertion. Weather data will be taken from one weather station in New York: Farmingdale Airport. Farmingdale Airport is the closest weather station to Bethpage State Park, the location where all the meets being studied were ran at. Other meets outside Bethpage will not be used because the different race conditions may introduce error into the results when dealing with running times. For this reason, college teams such as the Hofstra Men's Cross Country team were not considered, as they travel across the country, competing in a variety of environments.

The team's times will be averaged for each meet so a linear regression could be ascertained. This graph will be compared to weather values. Points that show an extreme variation from the graph will be marked and each weather condition will be compared against the others in order to determine which of the conditions has the greatest link to deviancy from the line of best fit. Then, a new graph can be created comparing this condition, say humidity to the average times for each meet. From this data, an optimal level can be determined.

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