Athletics Problem: Does Body Size Match Athletics Ability?: Instructor Guide

Title:

Athletics Problem: Does Body Size Match Athletics Ability?

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Discipline:

Statistics

Target Audience

Introductory, used with middle grade, gifted students

Keywords

Athletics, correlation, field, mathematics, statistics, track

Length of Time/Staging

At least two periods of 60 to 90 minutes and one week's time for group-work. It is advisable to have students start to work on the problem during a first class period. The teacher can then ensure that students understand the question. Students may start to gather data and by the end of the first class period, teacher(s) should ascertain the method(s) of data analysis that each group will use. At least one class period will be necessary for student presentations. The amount of class work time invested in the problem between the first class period and the presentation (final

class period) is at the discretion of the teacher. It is suggested that students have at least one week to collect, analyze, and formulate an answer for the presentation.

Abstract

The Athletics Problem is one that asks students to engage in computing a correlation while simultaneously looking at spread of data (standard deviation). Specifically, students are asked to look at demographic data, height, and weight to determine if any relationship exists between the event athletes do and their demographic data.

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Format of Delivery

The facilitator(s) will start talking about track and field with students. It is good to verify that students have a strong conceptual understanding of track and field. Students should be able to list a few events in track and field and they should be able to understand all events before the problem is completed.

Student Learning Objectives

1. Students will understand all events in track and field.
2. Students will understand basic principles related to kinesiology.
3. Students will have a conceptual understanding of correlation (NCTM, 2000)*.
4. Students will have a conceptual understanding of standard deviation (NCTM, 2000)*.

*Correlation is a grade 9-12 standard and spread is a 6-8 and 9-12 standard. Additionally, students have used charts and graphs to display data and this meets a grade 6-8 & 9-12 NCTM standard.

Student Resources

Students will be provided with a calculator, pencil, and paper. A laptop or desk computer will be necessary for students to investigate websites of track and field athletes. No access to statistical software, e.g. Microsoft Excel, Tinkerplots, Fathom, will be available, as the students are to investigate the concept of correlation and standard deviation conceptually.

Instructor Resources

The instructor must have a strong working knowledge of statistics. Specifically, the instructor should understand at least elementary principles of correlation and standard deviation (spread).

Teaching Notes

Potential solutions and tips for teachers:

This problem was designed for use with gifted students in grades 4-6 and is suitable for general population students in grades 7-10.

The ideal solution for this problem is that students would start to formalize a statistical correlation to identify whether or not body size has anything to do with athletic events. The spread of the distribution is integral to being able to determine whether or not an event has a prototypical size.

Teachers should discuss the fact that correlation is not causation. Discussion points include the topic that a certain type of body does not guarantee excellence at any certain event. Moreover, a certain body type does not preclude one from doing well in an event.

Regarding background knowledge, students should have a strong understanding of how data can be displayed and they should be able to chart data on a scatterplot. Students should further be capable of looking at how a set of data is spread (tight or wide). This activity can be used to introduce the basic principle of standard deviation and/or correlation. It could be used as an enrichment activity or an acceleration activity depending on the teacher's objective(s).

Assuming time is a consideration, as it is in many elementary/middle grade classrooms, the chart found at the website www.usatf.org/athletes/bios/ has been recreated in an excel document. Using this chart may save teachers and students as much as one to two hours in gathering data. Students are not limited to using this data set and they are encouraged to complete the analysis on one gender, not on both as the time involved to complete both genders may be significant. The list of females is shorter than the list of males.

Assessment Strategies

To assess the students, the teacher should be prepared to analyze presentations and statistical soundness of solutions. This form of analysis incorporates NCTM (2000) standards as communication and connections play a prominent role in the presentation. Also, students should be able to assess peer work. That is to say, peers in the course should be prepared to seek the most efficient or creative solution. The word 'most efficient' is used to indicate a solution that is sophisticated and that might be used by a more senior student. The word ‘creative’ is used to identify a novel solution. For example, if a student provides a solution that is new to the instructor, this could be considered a novel solution. Student solutions to this problem, in relation to creativity, have been discussed in a book chapter and the citation is listed below:

Chamberlin, S. A. (in press as of 7-6-07). The use of problem based learning activities to identify creatively gifted mathematics students. In O. S. Tan (book yet to be named). Feel free to contact the author at scott@uwyo.edu for additional information or discussion of assessment or implementation if you desire.

Solution Notes

The teacher should analyze the data and be prepared to discuss it with students. Various answers may exist. For example, if the teacher doesn't analyze all data, then the correlation or standard deviation may vary from student data. Also, if groups have invested time with certain events, the

standard deviations may vary from event to event. The numbers should be close (from student groups to teachers).

Initially, this data set was created to identify creatively gifted mathematicians. Hence, particularly novel solutions are sought in this problem. If students have an efficient way to analyze the data or if students analyze the data in a particularly complex manner (i.e. one of the more advanced correlation or standard deviation techniques), then the solution is considered creative. Alternatively, if one group comes up with a solution that varies significantly from the rest of the class, then this solution may be considered creative.