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**MIDDLE GRADE INITIATIVE**

**College and Career**

**C O N N E C T I O N S**

**P U L S E R A T E S**

**F O R S A F E A N D E F F E C T I V E E X E R C I S E**

Studying Sports Medicine opens the door to many opportunities, from serving as a Personal Trainer to traveling with a professional sports team. This **C O N N E C T I O N** ties the Sports Medicine Program at Grand Canyon University to Eighth Grade Science Standards.

**AZCCRS addressed in this C O N N E C T I O N:**

**Eighth Grade Science, Strand 1: Inquiry Process**

**Grand Canyon University, Sports Medicine**

**From their website:**

[**http://www.gculopes.com/sports/2010/1/21/GEN\_0121103257.aspx?&tab=5**](http://www.gculopes.com/sports/2010/1/21/GEN_0121103257.aspx?&tab=5)

“*Grand Canyon University's Athletic Training Program is an undergraduate major and is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP). Our program focuses on the application of skills as seen by our numerous laboratory classes and clinical rotations in the Training Room. We have an Athletic Training Student Club, which helps promote lifelong friendships in a Christian environment. At Grand Canyon University, our faculty and staff are dedicated to helping our students attain a balance in their spiritual, academic, and personal lives. We truly care about our students.”*

**Degree Program:**

**Bachelor of Science in Athletic Training** (Courses Include :)

**EXS 340; Physiology of Exercise -** This writing-intensive course is a study of the effects of exercise on the body. Topics include nutrition as the basis for physical activity; how energy is produced and utilized during physical activity; the energy delivery and vital functions of the respiratory, cardiovascular, muscular, and nervous systems during exercise; how these systems can be enhanced through training; the impact of ergogenic aids and environmental stress on performance; and the effect of exercise on body composition, weight control, aging, and disease prevention. The body’s responses and adaptations to exercise at the systemic, as well as the subcellular level, are also discussed.

**Lesson:**

**Students in the Sports Medicine programs at Grand Canyon University are focused on areas of treatment that are specific to athletic development and performance. Students learn not only how to best react to injury, but how to best design training programs that will maximize performance and avoid athlete risk. In this lesson, students will learn the process necessary to ensure that athletes maintain healthy heart rates during exercise.**

An important consideration in developing an effective and safe exercise routine, is achieving an optimal pulse rate. Pulse rate (heart rate) is the number of times a person’s heart beats each minute. If an athlete’s pulse rate during exercise is too low, her results may suffer, but if it is too high, she may be in danger. Pulse rate varies from athlete to athlete based on age, health, fitness, stress, medications and other factors so an optimal range needs to be calculated for each individual.

Students work in pairs to establish safe and effective pulse rates during exercise. (**Worksheets attached**) They measure their own pulse rates and calculate minimum and maximum values, using American Heart Association guidelines.

Next, students compile the data generated by the class for resting, minimum, and maximum pulse rates. In small groups, students will review the data and choose an appropriate graphic representation (line graph, double bar graph, stem and leaf plot or histogram) and produce a brief (one paragraph) summary of the results. Throughout the activity, the teacher will be monitoring student engagement and providing guidance.

**Deliverables and Assessment**

Standards by assignment

**Graphic Representation**

Science, Strand 1, Inquiry Process

Concept 4: Communication; PO1 and PO 2

Students will evaluated on the choice of an appropriate representation and the quality of the design.

**Summary of Results**

Concept 4: Communication; PO 3 and PO 5

Students will evaluated on the interpretation and communication of results.

**Teacher Observation**

Concept 4: Communication

**From the Arizona Department of Education Website:**

**AZCCRS for Eighth Grade Science**

Strand 1: Inquiry Process- Inquiry Process establishes the basis for students’ learning in science. Students use scientific processes as listed here: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, and communicating results.

Concept 4: Communication - Communicate results of investigations.

PO 1. Choose an appropriate graphic representation for collected data:

* line graph
* double bar graph
* stem and leaf plot
* histogram

(See M06-S2C1-02)

PO 2. Display data collected from a controlled investigation.

(See M06-S2C1-02)

PO 3. Communicate the results of an investigation with appropriate use of qualitative and quantitative information. (See W06-S3C2-01)

PO 4. Create a list of instructions that others can follow in carrying out a procedure (without the use of personal pronouns). (See W06-S3C3-01)

PO 5. Communicate the results and conclusion of the investigation.

(See W06-S3C6-02)

**Safe and Effective Exercise Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

An important consideration in developing an effective and safe exercise routine, is achieving an optimal pulse rate. Pulse rate (heart rate) is the number of times a person’s heart beats each minute. If an athlete’s pulse rate during exercise is too low, her results may suffer, but if it is too high, she may be in danger. Pulse rate varies from athlete to athlete based on age, health, fitness, stress, medications and other factors so an optimal range needs to be calculated for each individual.

What do you need to know to calculate a target range?

The formula for calculating pulse rates during exercise requires the following information:

Begin with the number 220 for males and 226 for females

The age (**A**) of the athlete

The desired percentage of capacity for the maximum (**MX**) and minimum (**MN**) rate The resting pulse (**R**) rate of the athlete

Find the target range for a 23 year old female with a resting heart rate of 67. Raising the athlete’s heart rate to its absolute maximum is not safe, so we will establish a desirable minimum (**MN**) and maximum (**MX**) for her target range. For this problem, we would like her heart rate to be 60% to 85% of its capacity.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **226** | **A = 23** | **MN = .60** | **MX = .85** | **R = 67** |

Begin with the number 226, because our athlete is female. Subtract her **A**ge. **226 – 23 is 203**

Next, we need to find 60% of that number, the rate at which exercise for this athlete becomes effective. Multiply **203** by **.60** **203\*.60 is 121.8**

Then we find 85% of the 203, in order to ensure safety. Multiply **203** by **.85. 203\*.85 is 172.6**

(We should round those because heart beats cannot be fractions! **122** and **173**)

**For this athlete, a safe, effective exercise program will keep her pulse rate between 122 and 173 beats per minute.**

Using variables, the formula looks like this:

Minimum effective pulse rate **(226 – A) \* MN**

Maximum safe pulse rate **(226 – A) \* MX**

Since the athlete’s resting heart rate is **67**, and our minimum pulse rate is **122**, we see that she must raise her pulse rate **55** beats per minute to reach the target range. **122 – 67 = 55**

Similarly, her maximum pulse rate for safety is **173. 173 – 67 = 106.** Our athlete must not raise her pulse rate more than **106** beats per minute to remain in the safe range.

**Another Example:**

Find the target range for a 36 year old male athlete with a resting heart rate of 71. He would like his exercise heart rate to be 65% to 75% of its capacity. Fill in the values below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **A =** | **MN =** | **MX =** | **R =** |

**The correct values for this problem are:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **220** | **A = 36** | **MN = .65** | **MX = .75** | **R = 71** |

(Why did we begin with 220 for this exercise?)

Now substitute to into the formula

Minimum effective pulse rate **(M – A) \* MN → (220 – 36)\*.65 = 119.6 (120)**

Maximum safe pulse rate **(M – A) \* MX → (220 – 36)\*.75 = 138**

For this athlete, a good target pulse rate is between 120 and 138 beats per minute. Because his resting heart rate is 71, he must increase his pulse rate by at least 49 beats but no more than 67 beats per minute to operate in the target zone.

**Taking your own pulse**

To find your resting heart rate, first find a clock that will measure seconds. Relax in a sitting position for a minute or so before measuring your pulse. Place your index and middle fingers just below your jawline on the side of your neck. Find your carotid artery, and count the number of beats in 10 seconds. Multiply that number by 6 to find the number of beats in one minute. That number is your resting heart rate.

**Use the formula with your own data**

Once you have your resting heart rate, you can use it to find your own target rates for exercise. (The American Heart Association recommends that you stay between 50 and 85 percent of your maximum heart rate.) What are the values of the variables?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **A =** | **MN =** | **MX =** | **R =** |

Minimum effective pulse rate **(M – A) \* MN ( \_\_\_\_\_ - \_\_\_\_\_ )\*\_\_\_\_\_ = \_\_\_\_\_**

Maximum safe pulse rate **(M – A) \* MX ( \_\_\_\_\_ - \_\_\_\_\_ )\*\_\_\_\_\_ = \_\_\_\_\_**

Using your own values for the variables, what is a safe and effective range for your heart rate during exercise?

What are the maximum and minimum values for the change in your pulse rate in order to remain in the target range?

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**Feedback**

**P U L S E R A T E S**

Thank you for taking a moment to share your feedback regarding the **College and Career** **CONNECTION, Pulse Rates**. We appreciate your time! Please send the completed form to Dawne.Spangler@nau.edu

Participant: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

District: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ School: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What grade(s) and subject(s) do you teach? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Please share your thoughts: Was this **CONNECTION**

**Relevant**? Yes Somewhat No

Comments

**Interesting to students**? Yes Somewhat No

Comments

**Practical**? Yes Somewhat No

Comments

What suggestions do you have to improve this **CONNECTION**?

What requests or suggestions do you have for new **CONNECTIONS**?