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Effects of Physical Exercise on Cognitive Performance

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Background

- Many studies have indicated a relationship between the level of physical exercise and cognitive performance (Keating, Castelli & Ayers, 2013; Colcombe & Kramer, 2003).
- All sports or exercises, in general, require sustained attention, focus, decision-making, and working memory at an optimal level. Over time, individuals generalize these skills which could positively enhance their cognitive performance in the long run (Furley & Memmert, 2011).
- Physical exercise effects on the college population
 - Jacobson & Matthaues (2014) found a significant relationship between the level of sports experience and executive functioning, which includes inhibition, effortful problem-solving, and decision-making.
 - Keating, Castelli & Ayers (2013) found college students who participated more in weekly strength exercises had a significantly higher GPA.
- Rohde and Thompson (2007) found that cognitive ability directly predicts academic performance.
- The effects of physical exercise on cognitive performance and GPA will be examined in this study. Cognitive performance will focus on logical reasoning, word-based math questions, verbal reasoning, and general knowledge. A possible correlation between GPA and exercise experience will also be explored.

Hypotheses:

Part 1: Participants who do more physical exercise will earn higher cognitive performance scores compared to participants who do less.

Part 2: Participants who do more physical exercise are predicted to have a relatively higher GPA compared to participants who do less.

Method

Participants:

- 38 undergraduate students participated in the study
- The study was presented online, using Qualtrics
- Compensation was given in the form of extra credit for psychology courses

Design:

- Single-factor between-subjects design
- Non-experimental
- Independent Variable
 - Exercise group (High participation vs Low participation)
- Dependent Variables
 - Cognitive Performance Score
 - GPA

Materials:

- Demographic & Physical Exercise Questionnaire
 - Each question regarding physical exercise scored in a range from 0-4. From this, the level of the physical exercise group was determined from the computed score from the questionnaire.
 - A median split was performed on the computed physical exercise scores. Participants with scores above the median were assigned to the high participation group and those with scores below the median were assigned to the low participation group.
- Wonderlic Personnel Test (2016)
 - Thirty questions were taken from the sample test.
 - The cognitive domains measured were **word-based math questions, verbal reasoning, logical reasoning, and general knowledge.**
 - Each question worth 1 point

How many times in a normal week do you engage in pre-planned physical activity?
 *Pre-planned physical activity: Any physical activity that is planned in advance with the goal to enhance your health, fitness, or well-being. Examples include going to the gym, cycling, team games, etc.

- 1-2 times
- 3-4 times
- 5-6 times
- 7 or more times

In general, what is the duration of each session of pre-planned physical activity that you engage in?

- Less than 10 minutes
- 10-20 minutes
- 20-30 minutes
- More than 30 minutes

A car dealership sells used cars for \$7,000 and new cars for \$16,000. If a total of 17 cars were sold for \$191,000, how many of the cars sold were used?

- A. 2
- B. 3
- C. 5
- D. 8
- E. 10
- F. None of the above

Joey got a 25% raise in his salary. If his original salary was \$1,200, how much was it after the raise was implemented?

- A. \$1225
- B. \$1500
- C. \$1350
- D. \$1450
- E. \$1800
- F. None of the above

Procedure:

- Consent form at the beginning of session.
- Demographic/physical exercise questionnaire
- Wonderlic Personnel Test.
- Debriefed and directed to another site for extra credit
- The session took approximately 15 minutes to complete.

Result

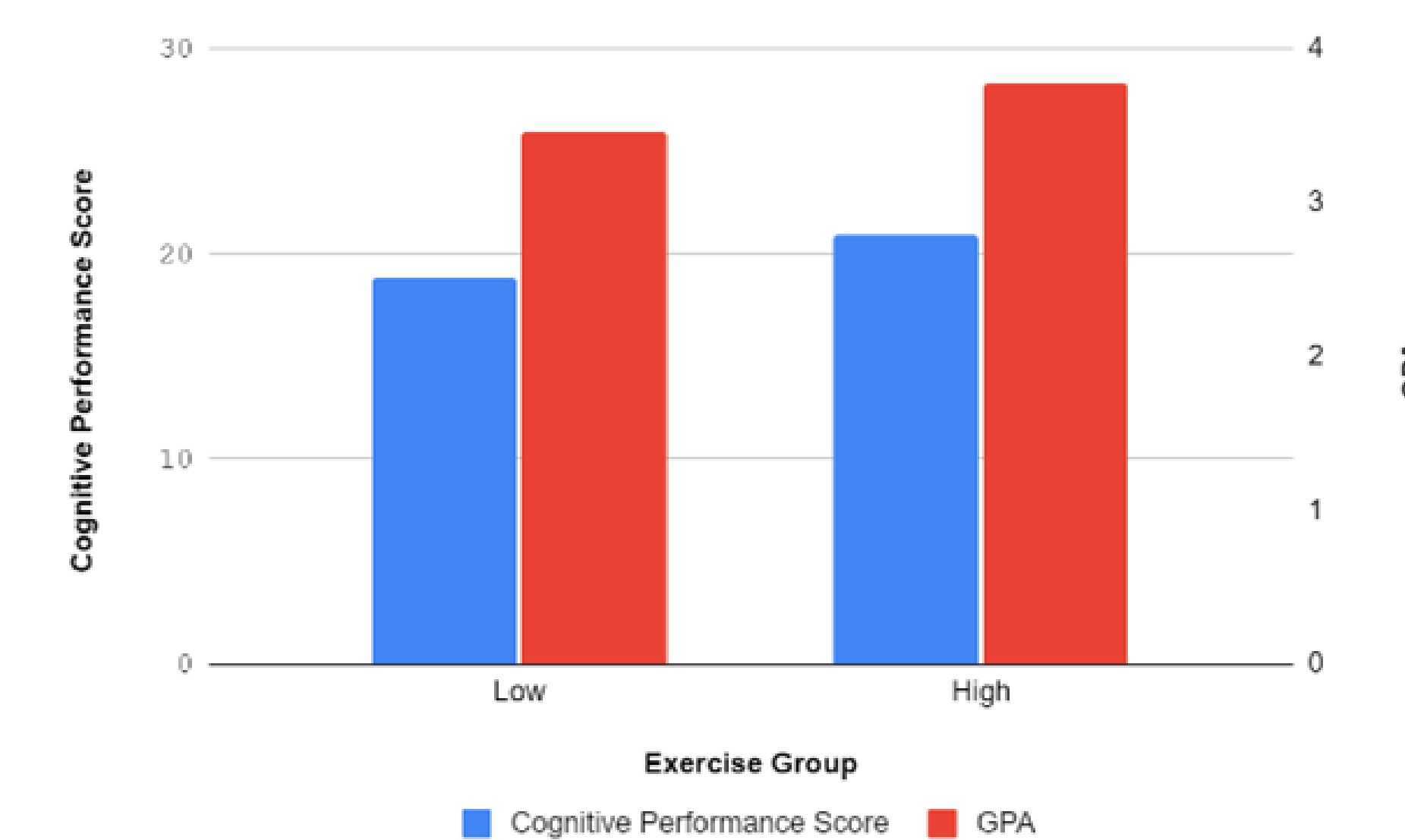
- The single-factor between-subjects ANOVA showed non-significant difference for **cognitive performance score** across exercise groups, $F(1,36) = 3.68, p = .063, \eta^2 = .093$.
- The single-factor between-subjects ANOVA showed a significant difference for **GPA** across exercise groups, $F(1,36) = 4.20, p = .048, \eta^2 = .104$.
- Pearson correlation coefficients were computed as a follow up
 - The relationship between cognitive performance and exercise score was not significant, $r(36) = .275, p = .095$.
 - The relationship between GPA and exercise score was also not significant, $r(36) = .285, p = .083$.

Table 1
Cognitive Performance Scores and GPA across Exercise Groups

	Cognitive Performance Scores	GPA
Low	$M = 19.05$ $SD = 4.61$	$M = 3.48$ $SD = 0.39$
High	$M = 21.95$ $SD = 4.70$	$M = 3.71$ $SD = 0.30$

Figure 1

Cognitive Performance Scores and GPA across Exercise Groups



Discussion

- Participants were likely to have a higher GPA if they exercised more frequently
- Frequency of physical exercise did not impact cognitive performance scores
- Pearson correlation coefficients during follow up showed no significant correlation between GPA and exercise score, nor between cognitive performance and exercise score.
- Limitations include lack of manipulation in the study, which makes it unclear if there is a causal relationship
- Another limitation is that this study did not explore other cognitive domains such as memory or attention
- Future studies should include a greater number of participants and test more domains of cognitive performance

References

- Keating, X. D., Castelli, D., & Ayers, S. F. (2013). Association of weekly strength exercise frequency and academic performance among students at a large university in the United States. *The Journal of Strength & Conditioning Research*, 27(7), 1988-1993.
- Colcombe, S., & Kramer, A. F. (2003). Fitness effects on the cognitive function of older adults: a meta-analytic study. *Psychological science*, 14(2), 125-130.
- Jacobson, J., & Matthaues, L. (2014). Athletics and executive functioning: How athletic participation and sport type correlate with cognitive performance. *Psychology of Sport and Exercise*, 15, 521-527.
- Furley, P., & Memmert, D. (2011). Studying cognitive adaptations in the field of sport: Broad or narrow transfer? A comment on Allen, Fioratou, and McGeorge (2011). *Perceptual and Motor Skills*, 113(2), 481-488.
- Rohde, T. E., and Thompson, L. A. (2007). Predicting academic achievement with cognitive ability. *Intelligence* 35, 83-92. doi: 10.1016/j.intell.2006.05.004

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