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Understanding what Influences Transfer Between Scientific Disciplines

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Our Purpose

Our research on Science Education has focused mainly on determining the ability for students to use far transfer when encountering challenging situations in a potentially unfamiliar science discipline. This may be done in in-person interviews, or online questionnaires designed to measure the transfer ability of the student volunteers. However, to do this, we need to test our measurements to determine if they are reliable and indicative of actual far transfer; the Transfer Test (TrT) and Conceptual Physics Test (CPT) were created for this purpose.

What is Transfer?

Transfer is the ability to utilize both problem-solving skills and previous factual knowledge on one subject to be able to work through a new challenge. For our research, we are looking at the far transfer capabilities of college students across scientific disciplines, seeing if having experience in certain science contexts can apply and be useful when encountering an unfamiliar scientific situation. Using our TrT and CPT, we are able to account for the difference between experience and previous knowledge of subject material to analyze if the results we see are indicative of what we expected.

Sample Items

Measuring original learning of energy concepts:
Conceptual Physics Test

At a construction site, a forklift raises a heavy steel beam upward at constant speed. Consider the following incomplete explanation:

As the forklift raises the beam upward at constant speed, there is _____ to the beam-Earth system, and the total energy (kinetic energy + gravitational potential energy) of the system _____.

Which choice best represents what goes in the blanks?

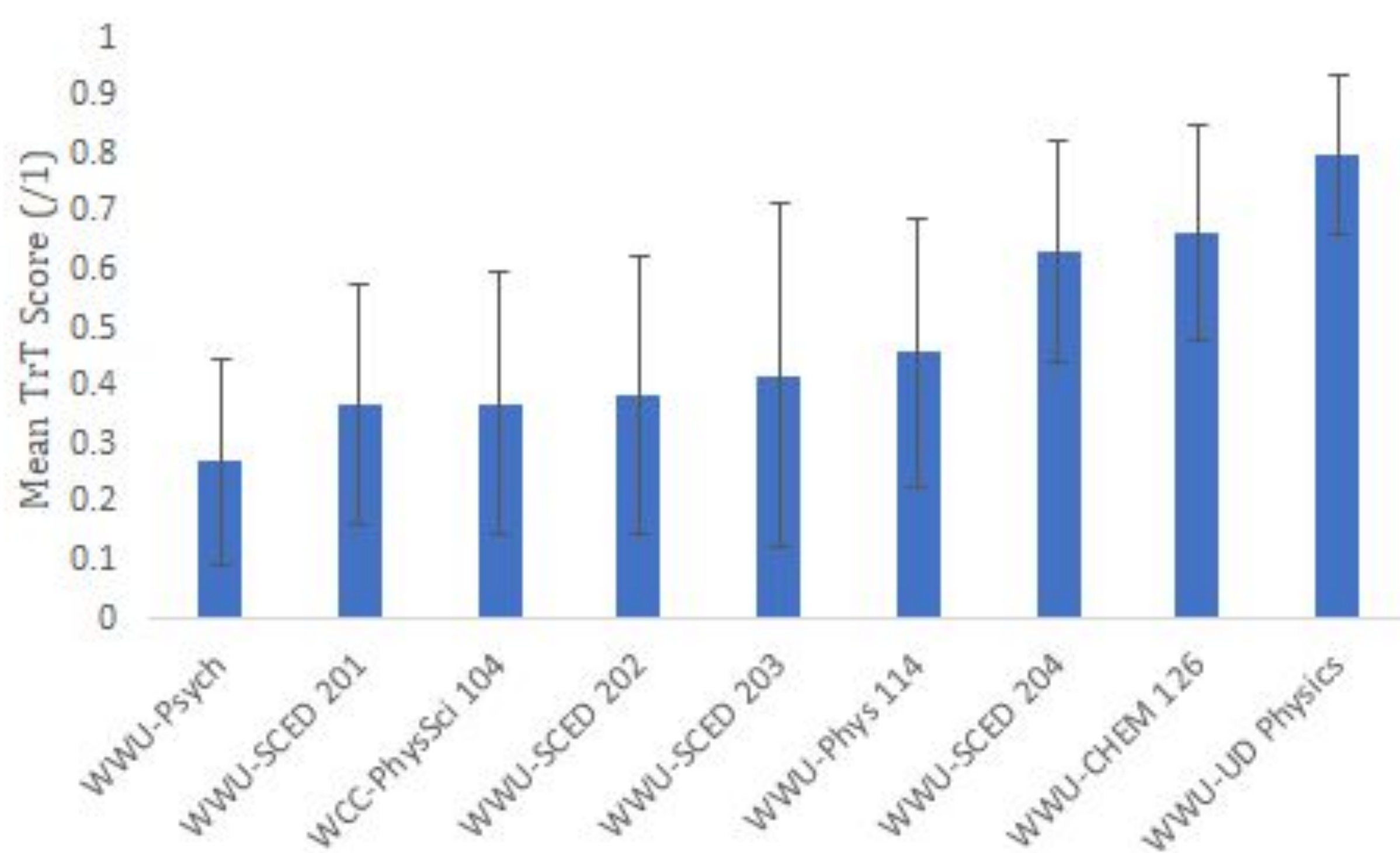
- a) an energy transfer, increases
- b) an energy transfer, remains constant
- c) no energy transfer, increases
- d) no energy transfer, remains constant

Measuring ability to transfer energy concepts:
Transfer Test

As shown above, an electron in a hydrogen atom jumps from a lower to a higher shell. The speed of the electron is the same before and after the jump. From the earlier to the later time:

- a) There was an energy transfer to the hydrogen atom *from* the environment.
- b) There was an energy transfer *from* the hydrogen atom to the environment.
- c) There was *zero energy transfer*.

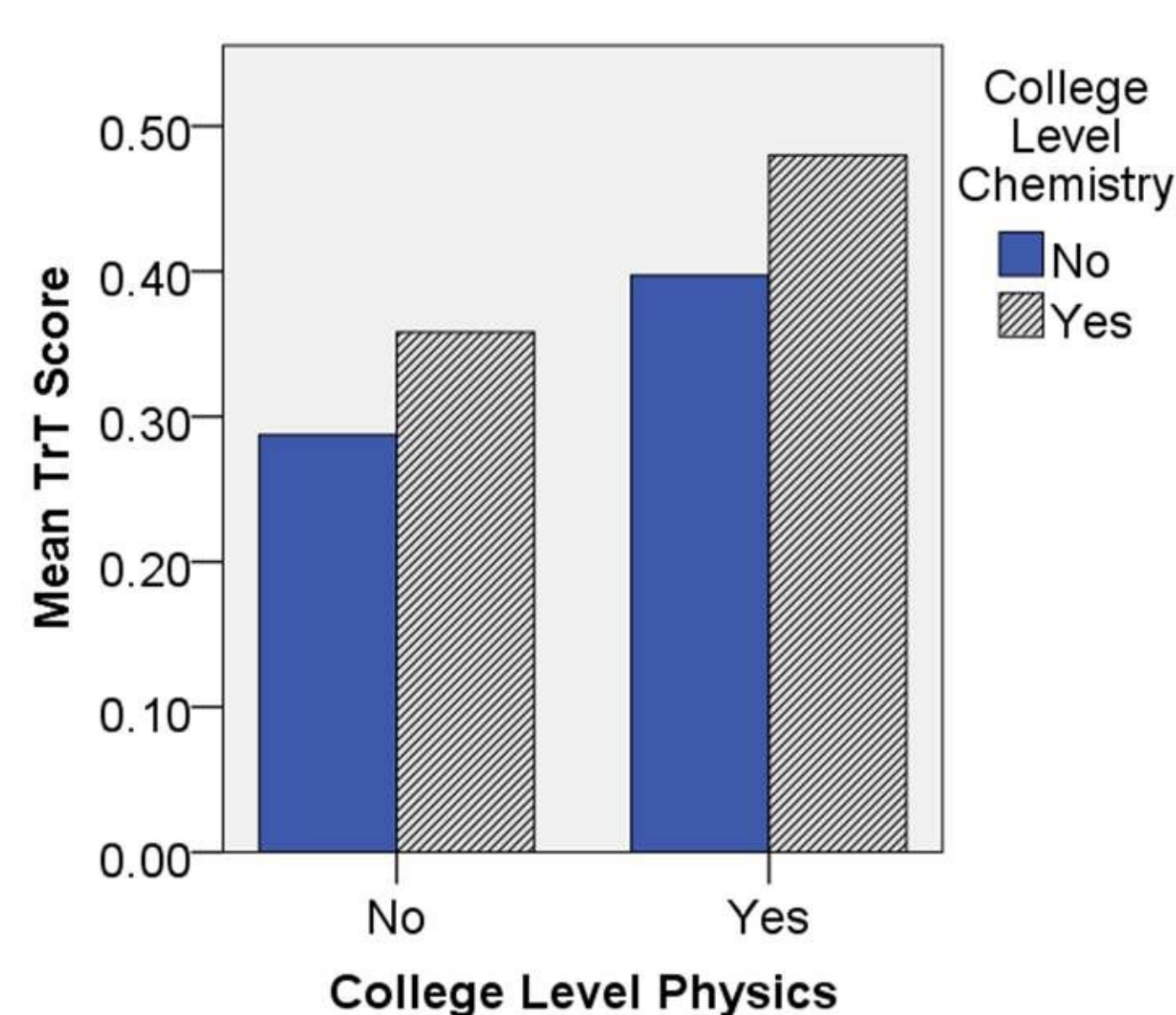
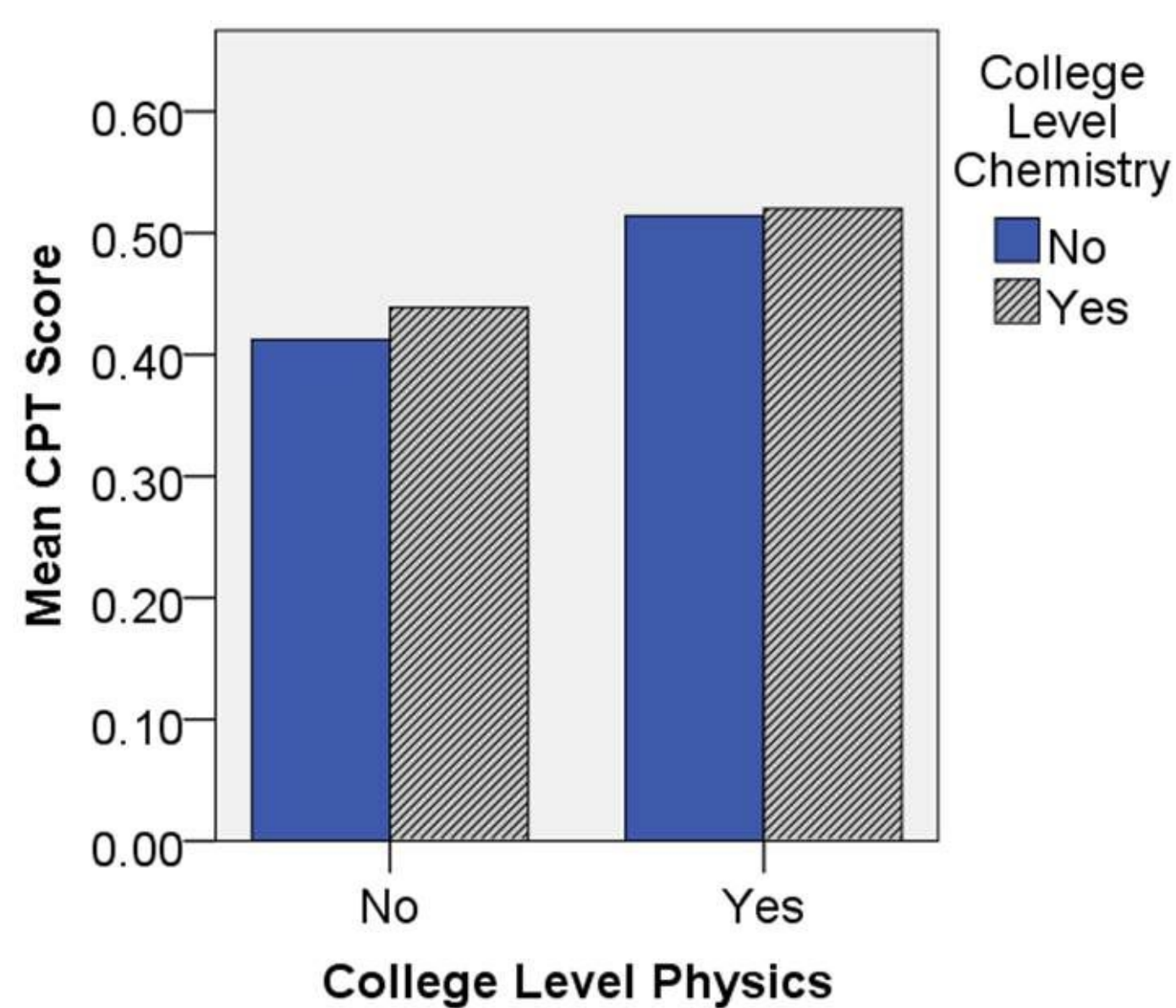
Current TrT Results



Evidence of validity

- CPT scores correlate to TrT scores ($r = .56$)
- Experts scored high on both assessments
- Students with more physics & chemistry coursework scored higher

Trends Indicating Transfer



Accounting for original learning (the CPT scores), the expected trend of students with more physics experience doing better in a physics test is shown. When analyzing the TrT data, there is still an evident trend of students with physics experience doing better in a chemistry test, regardless of whether they have taken a chemistry class before or not. The distinctions of data in each column allows for the data analysis to focus on transfer ability instead of problem-solving ability or prior knowledge testing.