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# DESCRIPTIVE STUDY

## The Association Between Critical Thinking and Scholastic Aptitude on First-time Pass Rate of the National Physical Therapy Examination

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### ABSTRACT

**Objectives:** 1) To investigate the relationships among critical thinking (CT) abilities, overall academic performance in the Doctorate of Physical Therapy (DPT) program as measured by cumulative grade point average (GPA), and National Physical Therapy Examination (NPTE) licensure scores, and 2) To determine if NPTE scores were significantly different between groups of students who were classified as having low, moderate or high CT abilities.

**Background:** It is well established that physical therapy practice requires good clinical reasoning skills. Passage of the NPTE is required for licensure. Research to date has been mixed as to whether CT abilities or GPA can predict success on national board licensure examinations such as the NPTE. The conflicting results may be partially due to weak research methodologies, uncontrolled confounders, and the use of non-standardized assessment instruments.

**Methods and Measures:** A convenience sample of 91 DPT students completed a standard assessment of CT abilities three times. Repeated measure (RM) general linear model (GLM) tests were run to determine if mean California Critical Thinking Skills Test (CCTST) scores changed significantly over the course of the DPT program. A Pearson's correlation matrix was constructed to investigate the relationships among NPTE scores, GPA, and CT. A univariate GLM test was run to determine if there was a statistically significant difference in mean NPTE scores between low, medium, and high CCTST groups. **Results:** Complete sets of the three CCTST scores were available for 69 students, and NPTE scores were available for 73 graduates. The strongest correlation with the first-time NPTE score was the GPA ( $r = 0.735$ ,  $p = 0.001$ ), followed by the CCTST score at Measurement 1 ( $r = 0.413$ ,  $p = 0.0001$ ). Graduates who were classified as having low CT abilities had a 100% failure rate on the first attempt for the NPTE, and scored significantly lower on the exam compared to graduates with moderate or high CT abilities (615.33, 634.6, and 652.43, respectively  $p = 0.0005$ ). **Conclusion:** Implementing pedagogical practices that foster CT abilities and/or using a CCTST score of 18 or greater as DPT program entry criterion may equate to greater first-time NPTE pass rates for program graduates.

### Background

Clinical reasoning is a process by which clinicians make professional judgments utilizing information provided by the client, evidence presented in scholarly literature, and knowledge gained through clinical experience.<sup>2,4,7,18</sup> Two related terms commonly associated with clinical reasoning are critical thinking (CT) and reflective problem-solving.<sup>8,11</sup> Critical thinking and

problem solving skills are considered significant enough to the physical therapy profession to be incorporated as prerequisite abilities for physical therapy education.<sup>9</sup> Critical thinking has been defined as a purposeful, self-regulatory, nonlinear, and recursive cognitive process to guide how to act in a given situation,<sup>8</sup> and a dynamic, purposeful, analytic process used to reach professionally informed judgments.<sup>12,14</sup> The link between critical thinking and clinical

reasoning in the health sciences is clear as CT is the process used to make a judgment about what to believe (diagnosis) and what to do about the symptoms a patient presents (treatment).<sup>8</sup> Thus, CT is essential to the process professionals use to make sound clinical judgments. These abilities are important for health care professionals, such as physical therapists, who must make well-informed, ethical decisions during patient care in uncertain and changing conditions.<sup>11-13</sup>

After graduation from an accredited program, physical therapy graduates must pass the National Physical Therapy Examination (NPTE) for licensure. Many allied health educators have used pre-program cumulative GPA as an indicator for successful degree program completion, but merely a handful have investigated the association between program grade point average (GPA) and first time score on the NPTE. Only one study, to date, has investigated the associations among CT, GPA, and NPTE scores. Presently, there are no reports in the published literature indicating if students with low critical thinking abilities earn significantly different scores on the NPTE compared to students with moderate or high critical thinking abilities.

With so much focus on developing CT abilities in PT education,<sup>1, 5</sup> it is important to determine whether CT can be measured. Two valid and reliable instruments for assessing critical thinking in college students are the Watson-Glaser Critical Thinking Appraisal (WGCTA) (Pearson Education, Inc., San Antonio, TX) and the California Critical Thinking Skills Test (CCTST) (Insight Assessment, Millbrae, CA). The WGCTA measures the CT skills of inference, recognition of assumptions, deduction, interpretation and evaluation of arguments with reliability coefficients of 0.74 to 0.81 for undergraduate students.<sup>17</sup> The CCTST is a standardized, 34-item,

multiple choice test that measures CT skills according to subscales of analysis, inference, evaluation, and inductive and deductive reasoning and also calculates a total CT score.<sup>6</sup> The subscales are not mutually exclusive so only raw total scores are suitable for statistical analyses.<sup>6</sup> The CCTST has reliability coefficients of 0.78 to 0.82 for both undergraduate and graduate students.<sup>6</sup> Additionally, the CCTST does not suffer from pre-test sensitization effects.<sup>6</sup> CT is not domain specific and the CCTST has been shown to yield valid CT assessments in students across multiple fields of study.<sup>6</sup> However, another instrument, the Health Science Reasoning Test (HSRT) may be a good alternative to the CCTST for assessing CT abilities in students studying the health science professions. The current study implemented the CCTST Version A to the first two cohorts of students prior to the release of the HSRT and could not switch test instruments in the middle of the study.<sup>3</sup>

Seeking to understand what prognostic indicators might predict success on the NPTE, research by Norman<sup>10</sup> and Vendrely<sup>16</sup> studied the relationship between a student's critical thinking abilities and the student's success on a standardized board exam. The Test of Logical Thinking (TOLT) scores of Norman's<sup>10</sup> physical therapy students were compared with their success on the GRE. The results demonstrated a statistically significant ( $p < .05$ ) weak correlation that a student's TOLT score would predict success on the analytical and quantitative subsections of the GRE.<sup>10</sup> Vendrely<sup>16</sup> reviewed physical therapy students' clinical education performance, academic performance, and critical thinking skills with their achievement on the NPTE. There was a statistically significant ( $p = .023$ ) association with the student's critical thinking scores as measured by the CCTST and their success on the NPTE.<sup>16</sup>

Of the referenced articles, only Vendrely<sup>16</sup> explored whether there was a relationship between GPA and success on a national standardized board exam and noted there was a statistically significant finding ( $p = .031$ ) that GPA could correlate to NPTE success. However, when Vendrely<sup>16</sup> completed a logistic regression analysis, the results revealed neither critical thinking skills nor GPA were statistically significant ( $p > .05$ ) predictors of success on the NPTE.

From the literature explored, it is evident that critical thinking is necessary to health related professions, but minimal research has been conducted specifically measuring CT in Doctorate Physical Therapy (DPT) education programs, and whether GPA or CT could predict success on national board examinations such as the NPTE. At present, there are no reports in the published literature indicating if students with low critical thinking abilities earn significantly different scores on the NPTE compared to students with moderate or high critical thinking abilities. Therefore, the purposes of the current prospective, descriptive study were twofold: 1) To investigate the relationships among CT, overall academic performance in the DPT program as measured by GPA, and NPTE licensure examination scores; and 2) To determine if NPTE scores were significantly different between groups of students who were classified as having low, moderate or high CT abilities.

## Methods

The Institutional Review Board at the University of Dayton (Dayton, OH, USA) approved this study and all participants provided written informed consent to participate.

### *Participants*

Participants were a convenience sample of three cohorts of students enrolled in the DPT

program at a private, faith-based Midwestern university. The sample consisted of 91 students (23 male; 68 female) in the DPT classes that graduated in May of 2009, 2010, and 2011.

### *Program Description*

The three-year (8-semester) DPT program integrates didactic, hands-on, and clinical experiences into their hybrid curriculum model. Problem-based learning is integrated for a total of 51 weeks in seven modules, which are divided into clinical areas including general medicine, neurology (adult and pediatric) and orthopedics. The didactic portion of the curriculum is enhanced by 38 weeks of full-time clinical training that is divided into four different clinical rotations providing experiential, hands-on reinforcement for classroom and laboratory instruction. These clinical internships are integrated to follow the major academic course work subcategories; specifically: general medicine course and lab work is followed by six weeks of acute care/general medicine clinical; neurology academics is followed by eight weeks of neurology clinical; introductory orthopedics course and lab work is followed by 12 weeks orthopedics clinical; and advanced orthopedics and specialized topics is followed by a 12 week elective clinical rotation.

### *Measures*

The CCTST version A was administered at the beginning of the second semester of the program (Measurement 1;  $n = 89$ ), 12 weeks following measurement 1 (Measurement 2;  $n=88$ ) and again in Fall of the third year of the program (Measurement 3;  $n = 87$ ). Students completed the CCTST in a classroom situation with a proctor present and under a 45-minute time limit. Only raw scores for the CCTST total were included in the statistical analyses and corresponding report because the CCTST subscales (analysis, inference, and evaluation, and

inductive and deductive reasoning) are not mutually exclusive. The registrar's office provided the weighted, cumulative grade point average (GPA) for each program graduate, and the program director accessed the NPTE score for each student who consented to have their score reported to the university.

### ***Data Analysis/Statistical Methods***

Descriptive statistics were calculated for all study variables. Repeated measures (RM) general linear model (GLM) tests were run to determine if mean CCTST scores changed significantly over the course of the DPT program with gender entered as a factor to determine if there were significant differences between these groups. A Pearson's correlation matrix was constructed to investigate the relationships among the scores graduates earned on their first completion of the NPTE, their overall GPA for the program, and Measurements 1, 2, and 3 of the CCTST. CCTST scores were categorized as low, medium, and high, respectively: scores lower than 18 (n=21); scores 18-22 (n=25); and scores higher than 22 (n=23). A univariate GLM test was run to determine if there was a statistically significant difference in mean NPTE scores in the three CCTST groups.

## **Results**

Ninety-one students (23 males and 68 females) completed the DPT program in May 2009, 2010, and 2011. Complete sets of three CCTST scores for Measurements 1, 2, and 3 were available for 69 students who voluntarily provided written informed consent to participate in the study (19 males; 50 females). RM GLM testing revealed that although mean CCTST scores increased steadily from Measurement 1 through 3, the change was not statistically significant (mean scores 19.95, 20.55 and 20.65 at Measurements 1, 2, and 3, respectively;  $p = 0.105$ ). There was not a significant

difference in mean CCTST scores between genders (mean CCTST scores 19.31 and 19.45 for males and females, respectively). NPTE scores were available for 73 graduates (20 males and 53 females). The strongest correlation with the first time NPTE score was the GPA ( $r = 0.735$ ,  $p = 0.001$ ), followed by the CCTST score at Measurement 1 ( $r = 0.413$ ,  $p = 0.001$ ). Measurements 2 and 3 of the CCTST scores were also significantly correlated with NPTE scores ( $r = 0.351$ ,  $p = 0.003$  and  $r = 0.410$ ,  $p = 0.001$ , respectively).

When NPTE scores were grouped as scores less than 600 (n=15), scores 600-649 (n=31) and scores 650 and above (n=27), there was a statistically significant difference in mean CCTST scores between those three groupings (16.67, 19.84, and 21.52, respectively  $p = 0.001$ ) (see Figure 1 for post hoc results). Similarly, mean GPA scores were significantly different between the 3 NPTE score groupings (3.44, 3.60, and 3.81, respectively  $p = 0.001$ ) and between the 3 CCTST score groupings (3.55, 3.63 and 3.74, respectively  $p = 0.004$ ) but not between genders (males 3.59 and females 3.64).

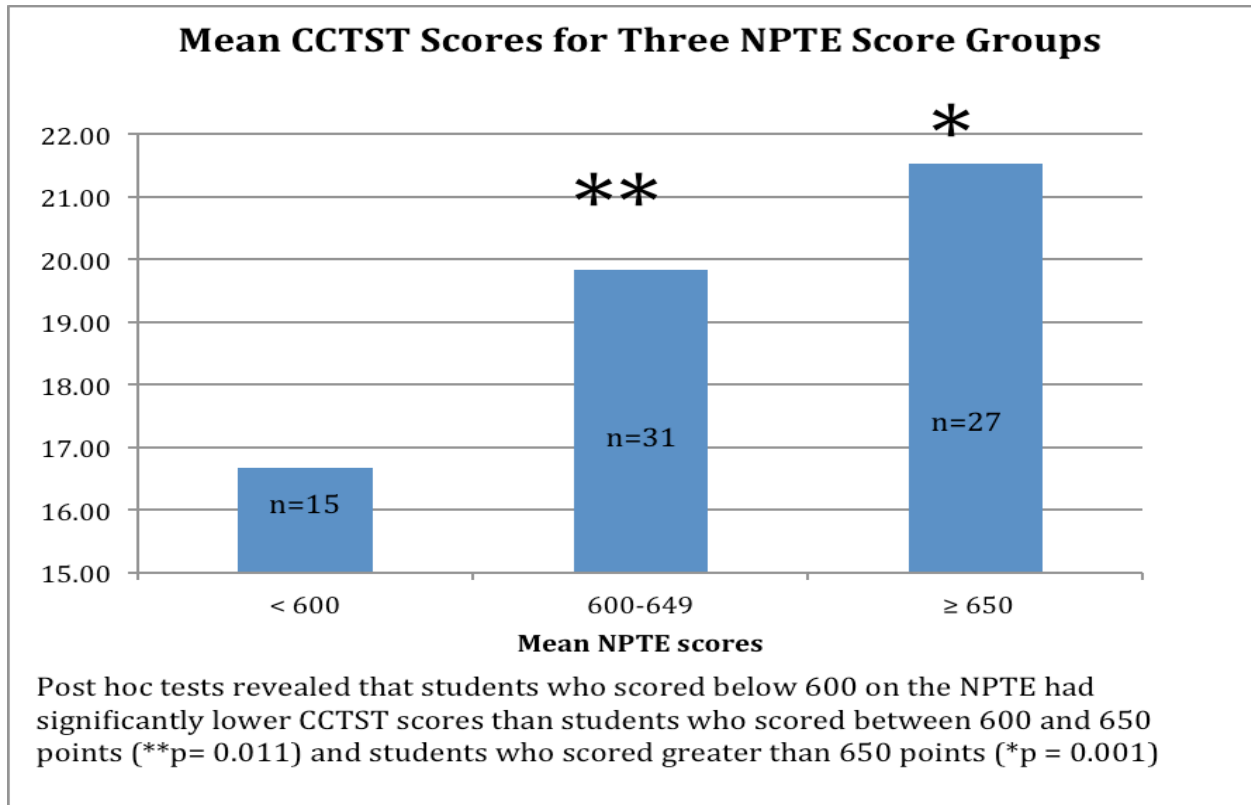
When CCTST scores were grouped as scores lower than 18, scores 18-22, and scores higher than 22 there was a statistically significant difference in mean NPTE scores between those three groupings (615.33, 634.6, and 652.43, respectively  $p = 0.005$ ) (see Figure 2 for post hoc results).

There was not a significant difference in NPTE scores between genders (mean NPTE scores 633.79 and 633.93 for males and females, respectively).

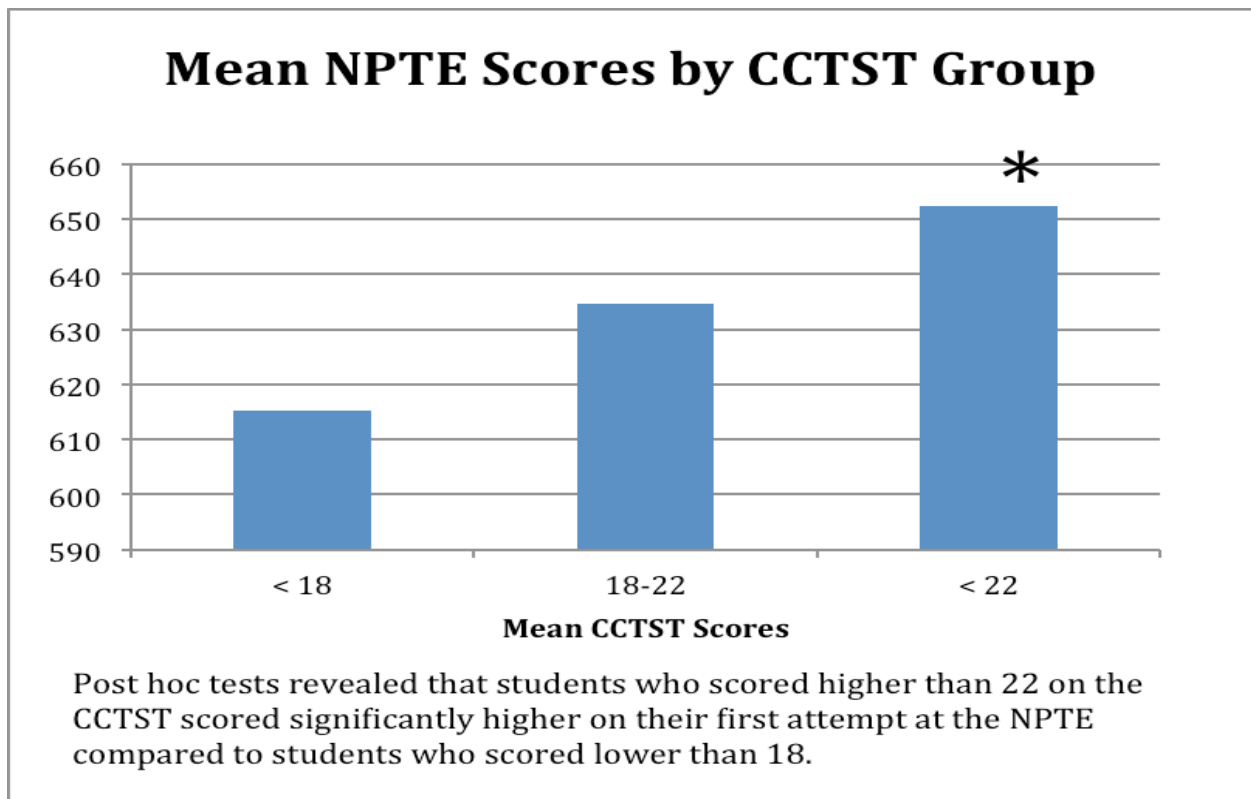
## **Discussion**

It is important for physical therapists to be able to think critically because rarely does a

**Figure 1:** Mean CCTST Scores for the Three NPTE Score Groups



**Figure 2:** Mean NPTE Scores for DPT graduates with Low, Moderate and High CCTST Scores





client present as a textbook patient. Accurate diagnosis and safe, efficient treatment plan development depends on a physical therapist's ability to observe, assess and distinguish a client's personal needs. Critical thinking and reasoning is a core competency necessary to adapt and cultivate a personalized approach to patient rehabilitation.

Perhaps the most important finding of this study was that PT students who scored below 600 points and thus failed the NPTE on their first attempt, had significantly lower CT scores than the students who passed the NPTE with mid- (600-649 points) and high-range (greater than or equal to 650 points) scores. To our knowledge, the level of critical thinking skills/abilities and the relationship to first time pass rate of the NPTE has not been previously demonstrated in the literature. As such, PT educators may consider using CT scores: 1) As a criterion for program admission; 2) As a prognostic indicator for first-time NPTE success; and 3) As impetus for program reform to foster growth in student CT. Each of these three points is discussed briefly below.

### ***Criterion for Program Admission***

In the current study, critical thinking ability, as measured by the mean total score on the CCTST, did not change significantly over three years in a DPT program. Even though all three measures of the CCTST were found to be significant, the change from the first measure to the last was not ( $p = 0.105$ ). This can be interpreted as, whatever level of CT a student enters physical therapy school, he or she is likely to be at that same level when they graduate. The literature on this topic of change in CT scores during schooling is inconclusive. However, the current finding is consistent with the majority of studies reviewed in a recent systematic review by Brudvig et al.<sup>3</sup> who did not find statistically significant gains in critical thinking scores during the course of PT education programs. Therefore, with the lack of significant

change in CT scores over the course of a PT program, it may be more advantageous for programs to screen prospective students for CT abilities during the initial application or interview processes.

### ***Prognostic Indicator for First-Time NPTE Success***

The significant impact of CT ability on first-time NPTE performance has been noted, yet it is worth mentioning, first-time NPTE failure rate is relatively low. Only 8% for Theiman et al.<sup>15</sup>; 11% for Vendrely<sup>16</sup>; and 20% for the current study as 15 of the 73 participants did not pass the NPTE on the first attempt. This low rate of failure may make it more difficult to accurately identify the significant predictors of first time NPTE success. Although not the focus of the current study, it is worth noting that all states allow applicants to re-take the NPTE exam a minimum of three times; and, 32 states have no limitation on the number of times an applicant can sit for the test. The licensure exam is offered four times per year. The program investigated in this study has a cumulative 99% success rate for its students passing the NPTE. Therefore, as such, while CT ability may not impact *overall* NPTE success rate, the first-time pass rate remains pertinent because the delay in licensure from not successfully passing the NPTE on the first attempt could result in significant financial hardship due to the inability to secure employment as a physical therapist.

### ***Impetus for Program Reform to Foster Growth in Student CT***

The finding of significant differences in the NPTE first-time pass rate for students who were grouped according to their CT ability and GPA may be useful to DPT faculty as they strive to prepare PT students to successfully pass the NPTE on their first attempt. Exploring and adopting pedagogical practices known to enhance CT abilities should be pursued in DPT education programs.

## Conclusion

The current results provide evidence that having an ability to think critically is important for physical therapy students. The findings in this study support that higher CT skills are positively associated with passing the NPTE on the first attempt in that all students who scored lower than 600 points on the NPTE fell within the group with the lowest CT scores as well. Additionally, there were statistically significant differences in NPTE scores for graduates of this program based on CT classifications of high, moderate, or low ability, with those students in the low CT ability group accruing significantly more first time failures on the NPTE compared to students of moderate and high CT abilities.

This information can be useful to program faculty as they either select prospective students with high CT abilities or strive to foster the growth of physical therapy students towards achieving the levels of competence necessary to successfully pass the NPTE on the first attempt. If the first course of action option is selected, it appears that a CCTST score of 18 or greater as a program entry criterion may equate to recruiting students with greater aptitude for first time NPTE success. If the second course of action is selected, DPT education programs may need to adopt pedagogical methods that are known to foster growth of CT abilities.

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