RELATIONSHIP BETWEEN CPI & LEARNING STYLES

THE RELATIONSHIP BETWEEN THE PHYSICAL THERAPIST CLINICAL PERFORMANCE INSTRUMENT SCORES AND DOCTOR OF PHYSICAL THERAPY STUDENT LEARNING STYLES

An Independent Research Study

Presented to

The Faculty of

Marieb College of Health and Human Services

Florida Gulf Coast University

In Partial Fulfilment

Of the Requirement for the Degree of

Doctor of Physical Therapy

By

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2017
RELATIONSHIP BETWEEN CPI & LEARNING STYLES

APPROVAL SHEET

This independent study
is submitted in partial fulfillment of the requirements for
the degree of
Doctor of Physical Therapy

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The final copy of this independent study has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.
ACKNOWLEDGEMENTS

I would like to acknowledge the hard work, cooperation, and support of the following people and organizations: Dr. Rose Pignataro, Dr. Jaqueline van Duijn, Dr. Ellen Donald, Philip Cruz, Sandy Terranova, David Petersen, Hay Group, The American Physical Therapy Association, and Florida Gulf Coast University.
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ABSTRACT

INTRODUCTION. The learning style of a student is an important factor in their ability to gain knowledge. This is especially important in challenging curriculums such as the Doctor of Physical Therapy (DPT) program. A common tool to assess one’s learning style is The Kolb Learning Styles Inventory (LSI). A common tool used to measure the progression of a DPT student’s clinical performance is The Physical Therapy Clinical Performance Instrument (PT CPI). The purpose of this study was to investigate the relationship between the learning style of DPT students and their progression of clinical performance.

METHODS. This study involves a retrospective, cross sectional analysis of data derived from four classes of DPT students: class of 2012, 2013, 2014 and 2015 (n= 103). 77 students met the inclusion criteria. The study compares student learning styles as assessed by the Kolb LSI-3.1, and clinical performance as assessed by the CPI. During the DPT curriculum, students complete five clinical experiences (Clinical I, II, III, IV and V). Changes were measured for each individual student using scores for each PT CPI category from midterm to final within each clinical experience. Progression of clinical performance was also measured by comparing the change in scores for each PT CPI category between the midterm of Clinic I and Clinic III, and between the midterm of Clinic III and the midterm of Clinic V.

RESULTS. Analysis showed no statistically significant relationship between DPT students’ learning styles and progression of clinical proficiency (p = .05).
DISCUSSION. The results suggest that regardless of learning style DPT students have an equal opportunity for success in their clinical education. Study limitations include manual entry of a large volume of data, potential subjective bias of clinical instructors on the PT CPI, and reliability limitations of the Kolb LSI 3.1. Future research regarding the relationship between learning styles and clinical performance should look at whether students who have assessed their learning style perform better clinically than those who have not. Additionally, studies should seek to learn whether the learning styles do in fact change throughout the curriculum, and if they do, whether updated assessment of learning styles throughout the curriculum improves a student’s clinical performance.
INTRODUCTION

Improving the quality of new Doctor of Physical Therapy (DPT) graduates is an important part of elevating the physical therapy profession as a whole. As stated in the American Physical Therapy Association’s (APTA) Vision 2020, physical therapists seek to be “recognized by consumers and other healthcare professionals as the practitioners of choice to whom consumers have direct access for the diagnosis of, interventions for, and prevention of impairments, functional limitations, and disabilities related to movement, function, and health.”

The rapidly advancing standards of the profession have compelled the APTA to update its vision even further. The 2013 update, “Vision Statement for the Physical Therapy Profession” goes on to say that, “Educators will seek to propagate the highest standards of teaching and learning, supporting collaboration and innovation throughout academia.”

In order to accurately assess learning and development of DPT students, DPT programs conduct a variety of standardized assessments. One assessment, the Physical Therapist Clinical Performance Instrument (PT CPI), is utilized in order to assess students’ knowledge, practical skills, and professional behaviors while they are engaged in clinical experiences. The PT CPI shows progression of knowledge and skills using 21 important categories essential to entry-level physical therapist practice and helps guide the clinical education of the student.

Another assessment measure, the Kolb Learning Styles Inventory, version 3.1 (LSI-3.1) has been used by many DPT and Allied Health programs. This instrument is based on experiential learning theory and is self-administered by
students to understand their own learning styles. The four major learning styles are diverger, assimilator, converger, and accommodator. Understanding the students’ preferred learning styles is important in improving acquisition of knowledge and skill. This information can assist clinical instructors (CIs) in selecting the most effective teaching methods for their students, and it can encourage DPT students to further develop multiple learning styles. As students become more mature and skilled learners, they become more proficient at using different learning styles and may develop a preference towards two different learning styles rather than just one. Information gathered by the PT CPI and LSI may provide DPT students and educators helpful insight into clinical learning and professional development.

The DPT program at Florida Gulf Coast University (FGCU) is a three-year postgraduate program with Spring, Summer, and Fall semesters. During the first semester, DPT students complete the Kolb LSI-3.1 as part of the orientation process. The early identification of a preferred learning style can help the students to more accurately assess their strengths and weaknesses and formulate an appropriate plan of action in order to improve weaker aspects of the learning cycle. This strategy may assist students in being able to effectively assimilate knowledge and understanding throughout the program.

Beginning in the Fall semester of the second year of the DPT program, the PT CPI is completed by students as a self-assessment, and it is also completed by CIs as a performance assessment at midterm evaluation and final evaluation of each full-time clinical experience. PT CPI scores are shown to be a reliable
and valid reflection of the DPT student’s progression in clinical skill and knowledge.\textsuperscript{11} One area that has not been fully explored is whether knowledge of students’ preferred learning style, according to Kolb LSI-3.1, may affect clinical performance. According to Kolb’s theory, students who are able to use multiple learning styles are more efficient in absorbing knowledge throughout the learning cycle.\textsuperscript{6-9} These students may be more flexible in choosing the appropriate learning style for the situation at hand, making them better at acquiring knowledge within the clinical environment. Therefore, it is postulated that students who use multiple learning modes are better equipped to perform at a higher level in the clinical setting, which could result in higher scores on the PT CPI.\textsuperscript{3-13}

**Purpose**

The purpose of this research study was to identify relationships between the students’ preferred learning style as assessed by the Kolb LSI-3.1 and the change in their performance during full-time clinical experience as measured by the PT CPI. Both the Kolb LSI-3.1 and the PT CPI collect important data, which can be relevant to the development of clinical performance in DPT students. Understanding the relationships between the DPT students’ learning style and the development of their clinical skills and knowledge may assist DPT educators in propagating the highest standards of teaching and learning. For example, DPT faculty may use this information to potentially identify groups of students who are projected to be more or less successful in their clinical experiences, and assist students in strengthening areas of weakness in preparation for full time clinical
experiences. Directors and coordinators of clinical education may use this knowledge to assist CIs in selecting opportunities and instructional strategies that are best suited for each individual student. In addition, understanding the relationship between learning styles and clinical performance can help DPT students select the best study strategies and anticipate areas of weakness and strength.  

**Literature Review**

In order to determine need for research involving LSI-3.1 and scores on the PT CPI, a thorough review of the literature was conducted using several search engines including CINAHL and ScienceDirect. Search terms consisted of “Kolb LSI + clinical performance instrument,” “Kolb LSI + CPI,” “Kolb LSI + DPT,” “Kolb LSI + clinical performance,” among others. This search of the literature did not reveal any evidence of prior research comparing the Kolb LSI and PT CPI within DPT students.

The Kolb LSI and PT CPI each explores different aspects of a student’s learning experience. The PT CPI is an instrument that is uniquely tailored for physical therapy students. It is designed to measure the skills progression of DPT students in full-time clinical rotations. The Kolb LSI-3.1 can be readily applied to students of all disciplines, as well as the general public. It was designed to show the preferred learning style and modes of learning of an individual. There are multiple versions of each instrument. Of these instruments, the PT CPI was the most recent, with the first version having been released in 1997, and the most current version having been released in 2008. The Kolb LSI
was first published in 1971, and its most recent update occurred in 2012. Each of these instruments has been continually refined and updated over the years. It is important that educators using these instruments (LSI-3.1 & PT CPI) understand the development, advantages, and limitations of each version in order to fully appreciate why specific versions of the inventories have been selected for use in this study.

**The Physical Therapist Performance Instrument.** The PT CPI is a tool that is widely used in the United States and Canada to assess the progress of physical therapy students’ clinical skills, while in clinical experiences, as they complete their professional education. The PT CPI was first made available in 1997 after 3 years of pilot testing, and was revised continually for the next 10 years. In 2006, the APTA officially approved the use of the updated PT CPI. After its most recent update in 2008, the instrument was made available online with additional features and minor modifications. Both the DPT student and the CI must complete an online training course in how to correctly use the PT CPI. This training is intended to improve the interrater reliability between the CI and DPT student, as well as all users of the PT CPI.

The PT CPI is divided into several different categories that are evaluated on 18 different performance criteria. Items 1 through 6 are related to professional behavior, while items 7 through 18 address patient management. These categories include qualities that CIs believe to be essential for entry-level DPT performance. For each performance criterion, there is a rating scale ranging from beginning performance to beyond entry-level performance. These rating
scales are completed at mid-term and final evaluation. There is also a check-box to signify that either the student or the CI would like to report any significant concerns to the clinical education coordinator. For each of the performance criterion, the CIs and the DPT students are required to provide comments that address the DPT student’s performance within five dimensions: supervision/guidance, quality, complexity, consistency, and efficiency. In addition to the comments for each of the performance criterion, there is also a summative comment section for the midterm and final evaluation of each clinical experience. The PT CPI is completed during each of the student’s full-time clinical experiences at FGCU (Clin I, Clin II, Clin III, Clin IV, and Clin V).

In a study conducted by Proctor et al. using the 1997 version of the PT CPI, the authors found that certain items had a lower completion rate. In addition, there were concerns about the rating scale and the length of the instrument. The newer online version of the PT CPI released in 2008 overcomes these limitations by requiring the student or CI to complete each section before allowing them to move onto the next section. The 2008 online version of the CPI also has a more precise rating scale: there are 21 anchors reflecting 6 well-defined milestones. The first of these milestones is “Beginner.” This milestone is for those students who require 100% supervision and guidance when working in the clinical setting. The second milestone is “Advanced Beginner” and signifies students who require supervision and guidance 75% to 90% of the time when working with patients who have simple clinical presentations, and 100% supervision and guidance when working with those who have more complex
diagnoses. Students in the “Intermediate” category require supervision and guidance less than 50% when working with patients with simple clinical presentations, and 75% of the time when managing complex cases. “Advanced Intermediate” performance involves supervision and guidance less than 25% of the time in working with unfamiliar patients or patients with complex presentations. These students are independent with foundational tasks, such as the ability to engage in clinical reasoning required for skilled assessment and intervention, and should be capable of managing 75% of a full-time physical therapist’s caseload. Students who meet criteria for “Entry-Level” performance should be able to function independently in the clinical environment and manage a full-time caseload, recognizing the need for additional consultation when working with complex cases. The last 5 milestones indicate advancing proficiency in clinical practice and are labeled “Advanced Beginner,” “Intermediate,” “Advanced Intermediate,” “Entry Level,” and “Beyond Entry Level,” respectively. Each of these last 5 milestone is subdivided into 3 unnamed progressive levels. These anchors have been implemented to provide a more precise and reliable measurement scale of the DPT student’s clinical performance. Another benefit of the update to the PT CPI is that it can be easily accessed and completed online by the DPT student and the CI. In addition, the ability to easily and quickly retrieve and manage the PT CPI data enhances efficiency, allowing Directors of Clinical Education and faculty at DPT programs to respond in a timely manner when there are problems in student clinical performance.
A prospective study including physical therapy students from the US and Canada found that the 2006 update to the CPI had good internal consistency (Cronbach alpha of 0.99) and validity.\textsuperscript{11} Validity was shown in the instrument’s ability to differentiate between students on early and final clinical experiences. The lowest criteria scores for the early clinical experiences ranged from 1 to 3 while the lowest criteria scores for final clinical experiences ranged from 5 to 7. A Spearman correlation was used to determine the relationship between students’ PT CPI scores and prior clinical experience (0.20 to 0.50) and the amount of remaining coursework (0.26 to 0.60). One limitation of this study was that it included participants pursuing bachelor’s and master’s degrees. The official 2006 version of the PT CPI was paper-based, while the official 2008 version the PT CPI is Web-based. In this study, the 2006 version was used. However, it was completed online like the 2008 version, so it is likely that the validity and reliability of the two instruments are comparable.

In addition to the PT CPI, several different instruments have been developed and implemented to measure the clinical performance and knowledge of DPT students. Some examples include the Clinical Internship Evaluation Tool (CIET), the Abilities-Based Assessment (ABA), and the Mastery and Assessment of Clinical Skills (Blue MACS).\textsuperscript{14,15,16} Another instrument which is widely used in Australia and New Zealand is the Assessment of Physiotherapy Practice (APP).\textsuperscript{17} A study compared the use of the APP to the older 1997 version of the PT CPI and found that the APP was preferred by both the DPT students and CIs.\textsuperscript{18} Significant changes have been made to the PT CPI since then, and therefore,
this comparison may now be less relevant.

**Kolb Learning Style Inventory.** In 1976, David Kolb published the *Learning Style Inventory: Technical Manual*. This book details a method for assessing an individual’s preferred style of learning, and describes how individuals use knowledge and experience to progressively gain even more knowledge. Kolb theorized that there were essentially two methods for grasping experience and two for transforming it to practical use. To grasp experience, individuals use concrete experience (CE) or abstract conceptualization (AC). Keys to transforming experience include reflective observation (RO) and active experimentation (AE). According to Kolb’s learning theory, one does not simply have an experience and automatically learn from it. In order to truly learn, the individual must progress through a cycle that involves all four parts of the LSI-3.1. They must have an experience (concrete experience), reflect on it (reflective observation), develop a concept in their mind (abstract conceptualization), and experiment with it (active experimentation), providing a new concrete experience. This cycle is intended to be a continuous, circular process moving from one part to the next as the individual progresses to deeper and deeper understanding. An assessment of an individual’s preferences for any of the four parts of the process is meant to give insight into their preferred methods of learning.

First year DPT students at FGCU complete the Kolb Learning Styles Inventory (LSI-3.1) during their first semester as part of a class discussion on developing professional skills, and they self-report their results to the FGCU DPT program during the session. The LSI is commonly used by healthcare
professionals to identify the ways that an individual learns the best. The Kolb LSI-3.1 is composed of 12 questions, in which the participant ranks their response from 1 to 4. Scores are used to determine preference for any of four types of learning: concrete experience (CE), abstract conceptualization (AC), reflective observation (RO), and active experimentation (AE). These values are then inserted into several equations, and results are displayed using a two-dimensional learning style classification system. The score for concrete experience is subtracted from the score for abstract conceptualization (AC-CE), which is a measure of how individuals take in experience. Next, the score for reflective observation is subtracted from active experimentation (AE-RO), which is a measure of how individuals deal with experience. Learning style classification options include: accommodator, converger, diverger, or assimilator. Each of these styles is explained within the workbook.

Each of the four learner types, accommodating, diverging, converging, and assimilating, involves different attributes and predilections. The accommodating style is characterized by concrete experience and active experimentation. Individuals with this learning style are strong in initiating tasks, being practical, and taking risks. The diverging style is characterized by concrete experience and reflective observation. Individuals with this learning style are said to be imaginative, open-minded, and able to recognize problems. The converging style is characterized by active experimentation and abstract conceptualization. Individuals with this learning style are strong in defining problems, solving problems, and reasoning. The assimilating style is characterized by reflective
observation and abstract conceptualization. Individuals with this learning style are strong in planning, creating models, and developing theories. These classifications, while not rigid and fixed, are helpful for the DPT students and the PT educators in developing learning and teaching strategies which may be more effective.

Knowing students' preferred learning style may assist CIs in helping students develop their ability in other aspects of the learning cycle. However, the DPT student may be more comfortable with one particular style and may revert to it in stressful, new, or very challenging situations (e.g. clinical experiences). CIs may use this knowledge to challenge their students to use behaviors from less comfortable learning styles under appropriate circumstances.

Although the Kolb LSI was widely praised as revolutionary and is still extensively used, there are several critical responses to its validity. In their critique of the Kolb LSI, Koob and Funk labeled it as, “suspect methodology” with a “general lack of support.” These authors found that the Kolb LSI made assumptions based on Kolb’s learning theories. Although Kolb’s theories suggest high variability within each of the learning styles, this variability is lost when scoring the LSI, since individuals are placed in only one of four categories. According to the think tank, Demos, the supporting research for learning styles, in general, is often “highly variable,” and when applied in the classroom, “some teachers, despite the best of intentions, are using learning styles in ways that constitute poor professional practice” (pg. 11). Some of the other research suggests inconsistencies in learning style assessment, such as gender
preference. One study found that the LSI was accurate for females but not for males.\textsuperscript{21} In his review of the literature, Mark Smith also found several weaknesses including the failure to adequately address reflection, cultural background, memorization, and the general complexity of learning.\textsuperscript{22}

Despite all the criticism, the Kolb LSI has been used extensively throughout academia, especially in health-related professions. By utilizing this tool for the current study, the researcher is able to make comparisons with studies which have also used the LSI.\textsuperscript{23, 24} The Kolb LSI-3.1 was published in 2005 and improved on previous editions by including a much larger, diverse sample for its normative group.\textsuperscript{25} The Kolb LSI-3.1 includes categories which identify individuals who learn better through hands-on experience versus theoretical book knowledge. Clinical experiences are a decidedly hands-on experience, and it may be of interest to learn if there is a relationship between DPT students’ self-identified learning style and their performance in their full-time clinical experiences. Also, there is a general consensus that there is not currently a better approach to the assessment of learning preferences. Instead, researchers are cautioned to consider the shortcomings of the LSI-3.1 when examining results.\textsuperscript{19, 20}

Since its original publication in 1976, the LSI has been updated three times. The current version 4.0 is a major overhaul, which includes nine, rather than four, styles. This revision was based on a study of the literature and attempts to address many of the issues discussed by the aforementioned critics.\textsuperscript{5} The updated version of the LSI is new and has yet to be sufficiently vetted. In
addition, data from the FGCU DPT students have already been collected using the LSI-3.1. For these reasons, this study used the LSI-3.1.

Several studies have been conducted using the Kolb LSI to determine the learning style preferences of health profession students, including physical therapy students. The converging style, involving a combination of abstract conceptualization and active experimentation, was found to be preferred among many healthcare students including respiratory therapists, occupational therapists, and physical therapists.26, 27 Active experimentation and kinesthetic learning were preferred among these groups as well. It is theorized that students with these learning styles are drawn to these occupations since they involve understanding both difficult concepts and physical activity.24, 26-29 According to Kolb, people with the converging learning style are best at finding practical uses for ideas and theories.10 As part of the DPT program, students learn abstract concepts on topics such as biomechanics, and physiology. They also actively experiment with this knowledge in labs and clinical experiences. A comparison between learning styles and clinical performance was conducted with medical school students in 1998. This study compared the Kolb LSI with, among other things, computer-based case simulations (CBX), which are commonly used to train medical students. The researchers concluded that there was no connection between the Kolb LSI and CBX measurements.27 Another study compared the results from different standardized assessments and found no correlations between PT CPI scores and GPA, scores on the National Physical Therapy Exam (NPTE), and scores on the California Critical Thinking Skills Test
Research Questions

This study was designed to investigate DPT student learning styles, as assessed by the Kolb LSI-3.1, and their relationship to student performance during the clinical experiences in a DPT program, as assessed by the PT CPI. Questions

1. Is there a statistically significant relationship between DPT students’ learning style as measured by the Kolb LSI-3.1 and the progression of knowledge and skills as demonstrated by the difference in CPI score from midterm to final during each of the 5 clinical experiences (i.e. Clin I, Clin II, Clin III, Clin IV, and Clin V)?

2. Is there a statistically significant relationship between DPT students’ learning styles as measured by the Kolb LSI-3.1 and the progression of knowledge and skills as demonstrated by the difference in midterm CPI scores obtained during the first clinical experience (Clin I) and third clinical experience (Clin III)?

3. Is there a statistically significant relationship between DPT students’ learning styles as measured by the Kolb LSI-3.1 and the progression of knowledge and skills as demonstrated by the difference in midterm CPI scores obtained during the third clinical experience (Clin III) and final clinical experience (Clin V)?

The first question asks whether there is a relationship between specific learning styles and the progression of clinical abilities over the course of each individual
clinical experience. The second question asks whether there is a relationship between specific learning styles and the progression of clinical abilities during the first half of the DPT program (i.e. introductory clinical performance). The third question asks whether there is a relationship between the possession of specific learning styles and progression of clinical abilities during the last half of the DPT program (i.e. advanced clinical performance).

**Hypotheses**

The researcher hypothesized that there would be a statistically significant relationship between DPT students’ learning style as measured by the Kolb LSI-3.1 and the progression of knowledge and skills as demonstrated by the difference in CPI scores from midterm to final during each of the 5 clinical experiences, the first and third clinical experiences (i.e. introductory clinical performance, and the third and fifth clinical experiences (i.e. advanced clinical performance).

**METHODS**

**Sample and Data Collection**

This study was approved by the Institutional Review Board (IRB) of FGCU (protocol number 2016-03). The potential participants were composed of students (n = 103) enrolled in the entry-level DPT program at FGCU (Class of 2012, 2013, 2014, and 2015). The research design utilized retrospective, cross-sectional data previously obtained by the Director of Clinical Education, Dr. Jacqueline van Duijn, during student assessment for the following courses: PHT 6822 Clinical Education I, PHT 6941 Clinical Education II, PHT 6942 Clinical
Education III, PHT 7946 Clinical Education IV, and PHT 7947 Clinical Education V, and Dr. Ellen Donald during PHT 6026 Explorations in Physical Therapy. The DPT program at FGCU began using the most updated PT CPI in Spring 2010, so earlier cohorts were excluded to maintain consistent versions of the instrument. Figure 1 shows the distribution of students within the cohorts. Choice of this time frame ensured that the version of the PT CPI used in this study was consistent and the most up to date. Data from students who did not successfully complete all 5 full-time clinical rotations, combined two clinical experiences into one clinical experience, or had any other missing information were excluded from the analysis.

![Graph showing student cohorts](image)

**Figure 1.** Student Cohorts: Number and Percentage out of Total (n=103; Missing Data: 10 students)

DPT students and their clinical instructors completed the PT CPI online during each full-time clinical experience (PHT 6822 Clinical Education I, PHT 6941 Clinical Education II, PHT 6942 Clinical Education III, PHT 7946 Clinical Education IV, and PHT 7947 Clinical Education V). The Kolb LSI-3.1 was
completed in class during the DPT students' first semester, as part of PHT 6026 (Explorations in Physical Therapy), using a paper survey (See Table 1 for data collection schedule). Data regarding clinical performance and learning style constituted part of the students' academic record and was maintained by the instructors of these courses, Drs. Jacqueline van Duijn and Ellen Donald, in accordance with guidelines protecting student privacy (FERPA: Family Educational Rights and Privacy Act).

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In compliance with FERPA, Drs. Jacqueline van Duijn and Ellen Donald abstracted data from the PT CPI and LSI-3.1 from student records, thereby preserving student anonymity. All personally identifying information such as student names, university identification number, names of the clinical affiliation site, and names of the clinical instructors was redacted. Each student was given an anonymous code, known only to the faculty members responsible for teaching the courses utilizing the LSI-3.1 and PT CPI. A new file, containing no personally identifiable information, was utilized for analysis. De-identified data containing
results of the LSI-3.1 and PT CPI were entered into the statistical software IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corporation (released 2013). Care was taken during the transposition of data by double checking every other student’s data with the original data set. Also, any outlier data such as data showing regression of CPI scores over time were re-checked.

**DATA ANALYSIS**

Descriptive analyses of data included frequency counts, percentages, as well as means, and standard deviations (where applicable) regarding number of participants, distributions of learning styles, CPI scores, and clinic types. Mean midterm and final CPI scores, and changes in scores were calculated for each clinical experience. In addition, the change in score from midterm to final for each clinical experience (Clin I, Clin II, Clin III, Clin IV, and Clin V) was calculated to reflect improvement in student performance during the second half of each full-time clinical experience after receiving feedback on the midterm from the CI (see Table 2). The change in score showing introductory clinical performance (midterm CPI from Clinic I to Clinic III) and the change in score showing advanced clinical performance (midterm CPI from Clinic III to Clinic V) were also calculated (see Figure 6). The Kruskal-Wallis one-way non-parametric analysis of variance was selected to examine the relationship between learning styles and CPI performance. This test was used for each of the three research questions to analyze the relationship between students’ learning styles (categorical data) and clinical performance (ordinal level data). The test result is significant if there is a difference between groups, which would indicate need for a post-hoc analysis to
determine which of the 4 learning styles was associated with the greatest difference in change score. The critical alpha level used for hypothesis testing was $p = .05$.

**Kolb LSI 3.1**

Learning style was classified according to Kolb’s four categories: diverging, assimilating, converging, and accommodating. Students whose learning style fell close to the line dividing two learning styles were placed in separate categories of Accommodating/Converging, Accommodating/Diverging, Converging/Assimilating, Diverging/Assimilating, and a center category. This allowed for more precise comparisons between distinct learning styles and improvements in clinical skills.

**PT CPI**

The PT CPI is scored using a 21 anchor scale for each of the 18 performance criteria. For the purposes of data analysis this score was converted into a 1-21 point scale. The first anchor representing “Beginner” was a score of “1” and the last anchor, a score representing “Beyond Entry Level,” was “21.”

**RESULTS**

Of 103 potential participants, the data of 77 were used (75%). There were 26 participants with missing data. The data were missing due to failure of student to complete course requirements, student absence during learning style assessment, and data entry omission by CIs. Analysis of student demographics shows that the students most often identified strongly with the four main learning styles. As shown in Figure 2, accommodating learners were the most prevalent
(28.6%). The order after that was Converging (25.3%), Assimilating (23.1%), and then Diverging (16.5%). The remaining students (6.6%) identified close to the line between two different styles. No students identified close to the Accommodating/Converging line or close to the center of the LSI chart.

According to the Kolb LSI 3.1, accommodating learners learn mostly from doing hands-on activities, converging learners convert theory into practice, assimilating learners are best at making logical sense from a large body of information, and diverging learners can see concrete situations from several different points of view.\textsuperscript{25}

![Figure 2. Learning Style Distribution](image)

<table>
<thead>
<tr>
<th>Learning Style</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodating</td>
<td>26</td>
</tr>
<tr>
<td>Diverging</td>
<td>15</td>
</tr>
<tr>
<td>Converging</td>
<td>23</td>
</tr>
<tr>
<td>Assimilating</td>
<td>21</td>
</tr>
<tr>
<td>Accommodating/Diverging</td>
<td>1</td>
</tr>
<tr>
<td>Converging/Assimilating</td>
<td>3</td>
</tr>
<tr>
<td>Diverging/Assimilating</td>
<td>2</td>
</tr>
</tbody>
</table>
There were 6 different clinic settings in which students worked. These settings were Acute Care, Inpatient Rehab, Skilled Nursing Facility (SNF), Outpatient Rehab (Adult), Pediatrics, and Home Health PT. Some settings were not suitable for first year students, such as Pediatrics and Home Health, so they were not represented until later in the program. For all clinics (I-V) the most common setting was by far the Outpatient Clinic (see Fig. 3). The standard deviations for each clinic type were 1.33, 1.51, 1.32, 1.26, and 1.10, respectively.

Figure 3. Setting Prevalence: Clinic I-V

Mean midterm and final CPI scores were calculated for each clinical experience (see Tab. 2-3). If a student achieved the “Entry Level” score of 17 for every one of the 18 criteria, they would have a total score of 306. The highest total score possible was 378 which would indicate that the student was “Beyond
Entry Level" in every category. The lowest total score possible was 18, meaning that the student was a “Beginner” in all 18 categories.

Table 2. Total Midterm CPI Scores

<table>
<thead>
<tr>
<th></th>
<th>Clinic I</th>
<th>Clinic II</th>
<th>Clinic III</th>
<th>Clinic IV</th>
<th>Clinic V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>293</td>
<td>341</td>
<td>343</td>
<td>371</td>
<td>367</td>
</tr>
<tr>
<td>Minimum</td>
<td>18</td>
<td>63</td>
<td>97</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Mean</td>
<td>137.64</td>
<td>189.64</td>
<td>227.75</td>
<td>264.15</td>
<td>285.1</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>58.87</td>
<td>52.17</td>
<td>48.3</td>
<td>49.5</td>
<td>47.8</td>
</tr>
</tbody>
</table>

Table 3. Total Final CPI Scores

<table>
<thead>
<tr>
<th></th>
<th>Clinic I</th>
<th>Clinic II</th>
<th>Clinic III</th>
<th>Clinic IV</th>
<th>Clinic V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>313</td>
<td>362</td>
<td>346</td>
<td>378</td>
<td>377</td>
</tr>
<tr>
<td>Minimum</td>
<td>78</td>
<td>18</td>
<td>18</td>
<td>216</td>
<td>282</td>
</tr>
<tr>
<td>Mean</td>
<td>192.91</td>
<td>244.51</td>
<td>269.79</td>
<td>311.23</td>
<td>325.7</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>58.17</td>
<td>57.94</td>
<td>49.57</td>
<td>28.35</td>
<td>19.54</td>
</tr>
</tbody>
</table>

The scores actually achieved by the students ran the full range of possible scores with 378 as the highest score actually achieved and 18 the lowest score achieved.

Figure 4. Mean Midterm and Final CPI Scores by Clinic
The change in CPI score from midterm to final in each of the clinical experiences was calculated. It was found that the greatest average change occurred during Clin I: 57.18 (+/-35.44). This trended down with respective average changes of Clin II, 55.14 (+/-48.85), Clin III, 42.46 (+/-49.34), Clin IV, 47.08 (+/-36.90), and Clin V, 40.60 (+/-40.49) (see Fig. 5). This suggests that the greatest improvement occurs earlier in the educational process, or students experience a ceiling effect with regard to clinical performance during the later stages of clinical education.

![Figure 5. Mean CPI Change Scores](image)

Change scores were calculated from midterm Clin I to Clin III and from Clin III to Clin V. It was found that the average change score was higher in the beginning of the curriculum than at the end (see Fig. 6). Again, this implies that students improve more quickly early on.
Research Questions

Progression of clinical performance in relation to learning style was examined in three ways. For each of the three research questions, PT CPI change scores and Kolb LSI 3.1 data were analyzed using the Kruskal-Wallis one-way ANOVA test. As stated in the Methods section, a critical alpha value of $p=0.05$ was used. A significant result (result lower than 0.05) with this test indicates a statistically significant difference among the distribution of CPI scores within each LS category.

Question number one asked if there was a statistically significant relationship between learning styles and progression of PT CPI scores from midterm to final in each of the 5 clinical experiences. Results of the Kruskal-Wallis test, returned critical $p$ values of 0.43 (Clin I), 0.17 (Clin II), 0.57 (Clin III),
RELATIONSHIP BETWEEN CPI & LEARNING STYLES

0.99 (Clin IV), and 0.70 (Clin V). This indicated that, for each clinical experience, there was no statistically significant difference in clinical performance (as measured by the CPI) among students with different learning styles (as categorized by the LSI-3.1). Therefore, post-hoc analyses reflecting the strength of the association between learning style and clinical performance were deferred.

Question two asked if there was a statistically significant relationship between learning styles and progression of PT CPI scores from midterm Clin I to midterm Clin III (introductory clinical performance). Figure 7 shows the average change scores for this interval per learning style.

![Figure 7. Mean Midterm Change Scores from Clin I to Clin III per Learning Style](image)

Results of the Kruskal-Wallis test returned a significance of 0.15, indicating there was no statistically significant difference in introductory clinical performance across each of the LSI categories. Therefore, further analyses examining the relationship between the progression of clinical proficiency during the first half of the clinical education process and learning style were deferred.
Research question three asked if there was a statistically significant relationship between learning styles and progression of PT CPI scores from midterm Clin III to midterm Clin V (advanced clinical performance). Figure 8 shows the average change scores for this interval for each learning style.

**Figure 8.** Mean Midterm Change Scores from Clin III to Clin V per Learning Style

Results of the Kruskal-Wallis test returned a significance of 0.96, indicating there was no statistically significant difference in advanced clinical performance across each of the LSI categories. Therefore, further analyses examining the relationship between the progression of clinical proficiency during the second half of the clinical education process (i.e. advanced clinical performance and learning style) were deferred.

**Discussion**

This study was designed to address gaps in the current knowledge about how learning styles can affect the clinical education of DPT students. There are
studies which examine the Kolb LSI, the CPI, and DPT students separately, but no studies which combine all three of these elements. With greater understanding of this relationship, professors and clinical instructors may be better prepared to offer the necessary tools to facilitate success for all students. More importantly, students may use this knowledge to identify learning strategies that complement their learning style, and seek opportunities to expand their skills and preferences.

Descriptive statistics revealed several pieces of information not asked by the main research questions of the study. Frequency data showed that the most common clinical location was the outpatient setting. Learning style analysis showed that the most common style in the sample was Accommodating (see Fig. 2) which differs from previous research conducted by Hauer and associates that identifies Diverging as the most common PT student learning style. Results of the analyses showed that, within the current sample, mean PT CPI scores tended to increase over the progression of clinical experiences (see Fig. 4). However, the average change in scores tended to decrease over the progression of clinics (see Fig. 5). This suggests that DPT students have a steeper learning curve earlier in the clinical education experiences.

This study shows that there is no statistically significant difference in students’ progression in clinical performance during entry-level DPT education as measured by the PT CPI when compared with student learning styles as assessed by the Kolb LSI-3.1. This information is valuable because it shows that students of all learning styles have an equal opportunity for clinical success.
There are many factors affecting the influence of learning style during clinical education. These include interactions between the students’ learning styles, and the learning style of the CI, the learning styles of the patients, and significant changes in a student’s life. As shown in the literature review, learning styles will typically change over time. It is entirely possible that over the course of 3 years of DPT education, some of the students changed their learning styles and/or expanded on the learning styles that they originally preferred. A possible change in learning preferences and the ability to adapt to challenges within the clinical environment is supported by the progression of clinical performance as measured by improvement in CPI scores throughout the course of the students’ clinical education.

Limitations and Future Research

The following are among the limitations to this study. Manual entry of thousands of data points created the possibility of omissions and incorrect data. The transfer of data from paper form to digital form could have also resulted in human error affecting the accuracy of the data set. The potential for error was mitigated by frequent checks for agreement between the original data and the spreadsheet used for analysis. With regard to CPI scores, it is important to acknowledge the possible influence of subjective bias of the CI when providing assessment of clinical performance. This is in addition to issues with reliability of the Kolb LSI and PT CPI as mentioned in the literature review.

This is a preliminary study. It is important that researchers continue to study the role that learning styles play in physical therapy education. As students,
professors, and clinicians develop a better understanding of learning style preferences, each can develop and identify strategies to promote successful acquisition of essential knowledge and skills. Future studies may wish to consider whether DPT students who are trained in identifying their own learning style perform better scholastically and professionally. These studies may also utilize a control group consisting of students who do not assess their learning styles to enable a comparison examining whether knowing one's learning style provides a statistically significant advantage in clinical performance, as well as other measures of academic and professional success. Longitudinal data collection and follow-up may be needed to determine whether learning preferences change throughout the course of DPT education, and if these changes enhance the progression of clinical performance. This could be studied by the continued self-assessment of learning styles throughout the DPT program prior to each clinical experience. Finally, consideration is warranted concerning whether clinical setting type has a different effect on clinical performance for different learning styles.
REFERENCES


