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Formative Assessment and Academic Performance as Predictors of National Physical Therapy Examination Success

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<u>Walden University</u>

College of Education

This is to certify that the doctoral study by

Tobi Fox Baldwin

has been found to be complete and satisfactory in all respects,
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Walden University
2021

Abstract

Formative Assessment and Academic Performance as Predictors of National Physical

Therapy Examination Success

by

Tobi Fox Baldwin

MS, California University of Pennsylvania, 2010

DPT, University of St. Augustine, 2004

MPT, University of St. Augustine, 2000

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

February 2021

Abstract

Physical therapy educational researchers have studied various factors that may or may not predict success on the National Physical Therapy Examination (NPTE). One factor that has not been studied extensively is the use of the Academic Practice Examination and Assessment Tool (APEAT) as a formative assessment. The purpose of this study was to determine the predictive power of the APEAT as a formative assessment along with Doctor of Physical Therapy (DPT) program grade point average (GPA) on success on the NPTE. Carless's learning-oriented assessment theory was used as the theoretical foundation for this study and to guide the analysis of a formative assessment's potential to predict success on a summative assessment. The research question was to determine how well APEAT scores and DPT program GPA can predict success on the NPTE. A quantitative, nonexperimental, correlational approach was used for this study to analyze retrospective data. A census from a DPT program in the southeastern United States was used for cohorts graduating from Summer 2019 to Summer 2020; the sample size was 209 student records. Data from the student records were analyzed with binomial logistic regression. APEAT scores and DPT program GPA were statistically significant predictors of success on the NPTE. APEAT was a weak predictor, while DPT program GPA was a strong predictor of success on the NPTE. The results from this study may be used at the local site to identify students who may need remediation before taking the NPTE and hence lead to positive social change for these students. Because NPTE success is tied to program accreditation, the results from this study can be used to improve programmatic outcomes and instill social change at the local site.

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Chapter 1: Introduction to the Study

The topic for this study was to identify whether there was a predictive relationship between a standardized formative assessment, grade point average (GPA) in the Doctor of Physical Therapy (DPT) program, and successfully passing the summative National Physical Therapy Examination (NPTE). Upon completion of a DPT program, the newly graduated student must successfully pass the NPTE to become a licensed physical therapist in the United States. DPT programs look for ways to identify students who may or may not be successful on the NPTE prior to graduation (Wolden et al., 2020).

The Academic Practice Examination and Assessment Tool (APEAT) is administered by the Federation of State Boards of Physical Therapy (FSBPT, 2019). This tool is intended to be used as a formative assessment. The FSBPT, which also administers the NPTE, reported that scoring over 600 on the APEAT correlated with a passing score on the NPTE (FSBPT, 2019). However, there is a paucity of literature that corroborates this report (Crawley et al., 2015; Michaels et al., 2019).

This study has the potential for positive social change by adding to what is known about variables that predict success on the NPTE. This information will benefit physical therapy students, educators, and programs. Increasing passing rates on the NPTE may improve programmatic outcomes that are required by accrediting agencies. If the APEAT can be used to predict outcomes on the NPTE, students who do not meet standards for predicting success can be provided targeted instructional interventions to increase their NPTE success based on APEAT formative assessment and feedback. Improved

programmatic outcomes could improve program quality and impact social change

through improved education of prospective physical therapists.

This chapter will include sections on background research, the problem statement,

and the purpose of the study. The research question and the theoretical foundation will be

discussed, along with the nature of the study. Definitions, assumptions, and limitations

will also be described.

Background

Physical therapy educational researchers have studied a variety of factors that

may or may not predict success on the NPTE. GPA at the end of the first year of the DPT

program as well as at the end of the DPT program have been studied (Huhn & Parrott,

2017; Kume et al., 2019; Meiners & Rush, 2017; Wolden et al., 2020). Admissions

criteria such as the Graduate Record Examination (GRE) and GPA in undergraduate

course work have also been studied (Bayliss et al., 2017; Coleman-Salgado & Barakatt,

2018; Roman & Buman, 2019). Minimal research has been conducted on the APEAT as a

formative assessment that may predict success on the summative NPTE. Within the

studies that mention the APEAT, there are conflicting results regarding the correlation

between a passing score on the APEAT and passing the NPTE (Crawley et al., 2015;

FSBPT, 2019; Michaels et al., 2019).

The gap in practice that this study addressed is the understanding of the practical

application and relationship between the APEAT as a formative assessment and GPA

among recent graduates of a DPT program and success on the NPTE. Formative

assessments are used to provide feedback and learning opportunities to students (Black &

Wiliam, 1998). As a formative assessment, the APEAT should offer learning opportunities to the student to remediate weaknesses prior to taking the summative NPTE. GPA has been studied as a predictor of success on the NPTE but has not been considered in conjunction with the APEAT. This study was needed to address the gap in practice as well as the gap in the literature regarding the predictive relationship between the APEAT, GPA in the DPT program, and success on the NPTE.

Problem Statement

The problem that was addressed by this study was the decrease in success on the NPTE that a particular DPT program in the southeastern United States is trying to counteract with better preparation, such as administering the APEAT. The decrease in success on the NPTE at the local site has been discussed in faculty meetings, along with recommendations for strategies to improve NPTE success. Faculty selected the APEAT to be used as a formative assessment to improve NPTE success; however, there is a gap in understanding of the practical application and relationship between the APEAT as a formative assessment tool, GPA in the DPT program, and NPTE success. Because DPT programs are investing in the APEAT, it would be valuable to know how scores on the APEAT, as a formative assessment, and GPA in the DPT program are related to scores on the NPTE, as a summative assessment. Studies have been inconclusive on the relationships between APEAT as well as GPA and NPTE success (Crawley et al., 2015; FSBPT, 2019; Michaels et al., 2019).

Researchers have studied factors that predict success on the NPTE, but the APEAT has not been included as a variable in many studies (Bayliss et al., 2017; Carp et

al., 2020; Coleman-Salgado & Barakatt, 2018; Cook et al., 2015; Kume et al., 2019). For example, the first- and third-year GPA in one physical therapy program had a strong correlation to a first-time passing score on the NPTE; however, the APEAT was not included in that study (Wolden et al., 2020). Results of other studies showed that a combination of undergraduate GPA and DPT program GPA could predict success on the NPTE (Bayliss et al., 2017; Cook et al., 2015; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020). At one DPT program in the southeastern United States, according to the program director, the APEAT has been implemented as a tool to better prepare students for the NPTE in response to a recent decrease in first-time pass rates on the NPTE. Even though the APEAT is used extensively to prepare DPT students for the NPTE, it has not been included in studies that looked at GPA as a predictor of success on the NPTE.

Purpose of the Study

The purpose of this study was to determine the predictive power of a formative assessment and course assessments on success on the national licensure examination of physical therapy students in the DPT program of a local university in the southeastern United States. This quantitative study explored the predictive relationship between the APEAT score and GPA in the DPT program as the independent variables and success on the NPTE as the dependent variable. I hypothesized that there would be a predictive relationship between the score on the APEAT, DPT program GPA, and success NPTE.

Research Question and Hypotheses

To achieve the purpose of this study, I investigated one research question to determine the predictive relationship between APEAT scores, DPT program GPA, and success on the NPTE.

RQ: To what extent do APEAT scores and DPT program GPA predict NPTE success of DPT students?

H_0: APEAT scores and DPT program GPA are not significant predictors for NPTE success of DPT students.

H_A: APEAT scores and DPT program GPA are significant predictors for NPTE success of DPT students.

Theoretical Foundation

The theoretical foundation for this study was Carless's model of learning-oriented assessment (LOA; Carless, 2007, 2015). This model addresses the concept that assessment should also improve student learning and should not be assessment only for a grade or certification (Zeng et al., 2018). There are three main principles associated with LOA: (a) assessment should stimulate learning, (b) assessment should include peer and/or self-reflection, and (c) feedback should be forward-looking to support learning (Carless, 2007).

Both formative and summative assessments are included within the LOA model. The APEAT, as a formative assessment, includes self-reflection of the student performance as well as feedback on content areas needing further learning or practice. I used the LOA model to frame the research question and data analysis for this study to

help demonstrate the alignment of formative and summative assessment tools to improve student learning and programmatic outcomes. The LOA model and its relationship to this study will be further expanded upon in Chapter 2.

Nature of the Study

The nature of this study was quantitative, nonexperimental, and correlational, as it involved analysis of retrospective data (Seeram, 2019). Data were explained with logistic regression analysis to identify a predictive relationship of the two independent variables APEAT scores and DPT program GPA on success on the NPTE. Logistic regression analysis was appropriate in order to determine a predictive relationship between the three variables (Curtis et al., 2016).

The independent variables were the APEAT scores and the DPT program GPA. These are the variables that were measured within the student. The two independent variables were measured as a continuous data set. The dependent variable was success on the NPTE. This variable was measured categorically as "yes" the student was successful or "no" the student was not successful on the NPTE (Curtis et al., 2016).

Data were collected at the local site, which was a DPT program in the southeastern United States. Data were de-identified and organized by a research assistant. I obtained Institutional Review Board (IRB) approval from Walden University as well as the local site. Course faculty collected APEAT scores as a formative assessment in a course in the seventh trimester of an eight trimester DPT program. GPA at the end of the DPT program was obtained from the registrar's office. NPTE success is released by the FSBPT to DPT programs.

Definitions

Formative assessment – an evaluation of learning that is not tied to a grade or

academic achievement. It provides feedback to the learner and the instructor for

improved learning and achievement of standards (Black & Wiliam, 2009; Taras, 2005).

For the purposes of this study, formative assessment is any form of assessment, such as

the APEAT, that is not graded but provides feedback to the student on performance.

Summative assessment – an evaluation of learning that occurs at the end and is

often the final or cumulative judgment of student achievement (Taras, 2005). For the

purpose of this study, summative assessment is assessment that is high stakes,

cumulative, and results in licensure in an allied health profession.

NPTE success – a score of 600 is considered passing or success on the NPTE.

This standard is set by the FSBPT, which administers the NPTE (FSBPT, 2019).

Assumptions

There were a few assumptions within this study. The first was that grading within

the DPT program has been consistent for the past 2 years, ensuring that the GPA at the

end of the DPT program for students in different cohorts is consistent. The second

assumption was that the students studied and put the same effort into preparing for the

APEAT that they did for the NPTE. The third assumption was that the students had the

metacognitive abilities to self-reflect and apply the feedback from the APEAT to improve

their learning and subsequent performance on the NPTE.

Scope and Delimitations

The specific focus of this study was on the predictive relationship of APEAT scores, DPT program GPA, and success on the NPTE. Many researchers have studied factors that predict success on the NPTE (Bayliss et al., 2017; Carp et al., 2020; Clark & Chiu, 2019; Cook et al., 2018; Huhn & Parrott, 2017; Kume et al., 2019; Roman & Buman, 2019; Utley et al., 2016). Various factors have been identified; however, there is minimal research on the relationship of the APEAT as a formative assessment on NPTE success, and within the few studies, there are conflicting results (Crawley et al., 2015; FSBPT, 2019; Michaels et al., 2019).

The specific population included in this study was a sample of convenience. Data from DPT students in a DPT program in the southeastern United States were used. The students in this program complete the APEAT as part of formative course work in the seventh term of an eight-term DPT program. The APEAT was added to the DPT program coursework in the spring of 2019. Cohort data before the graduating class of Summer 2019 were excluded as those students did not complete the APEAT.

Because of the specific population and sample of convenience, the results from this study cannot be generalized to all DPT programs within the United States. Each DPT program has a different curriculum formulated around accreditation standards (Commission on Accreditation in Physical Therapy Education, 2019). The institution has multiple programs across multiple campuses, all of which share a common curriculum. The results from this study may be generalizable to the seven other DPT programs within the same institution from which this sample was retrieved.

Limitations

One potential limitation of this study was that it was conducted at one DPT program at one University. Using one DPT program makes it difficult to generalize the results from this study to all DPT programs in the United States. Another limitation is that the APEAT is developed and administered by the FSBPT. The APEAT consists of retired questions from prior iterations of the NPTE (FSBPT, 2019). The APEAT was not the only practice examination available to students. As students prepare for the NPTE, they use multiple practice examinations. These practice examinations are available from FSBPT as well as other agencies that offer licensure examination preparation. This may create an unknown effect of repeated testing, which was a limitation of this study. A third limitation of this study was that the dependent variable was used dichotomously. NPTE scores were not available for all students; only pass or fail was available. Using the NPTE score as a dichotomous dependent variable limited the conclusions that can be made from this study.

Significance

This dissertation addressed a gap in practice based on a gap in the literature regarding curricular and FSBPT recommended predictors of success on the NPTE (Crawley et al., 2015; FSBPT, 2019). It provided an original contribution to the practice of physical therapy education by adding to what is known about predictors of NPTE success at a local site. In this study, I examined the use of a formative assessment (i.e., the APEAT) and DPT program GPA as predictors of NPTE success, which is a summative assessment for licensure. At the local site, this study will permit

administrators to use the formative APEAT with new fidelity for predicting scores on the NPTE. This specific application is important, given a recent decrease in first-time pass rates on the NPTE.

This study will benefit physical therapy students, educators, and programs by adding to what is known about variables that predict success on the NPTE. Increasing NPTE scores and passing rates may improve programmatic outcomes that are required by accrediting agencies. At the local site, it is essential to know how NPTE pass rates can be improved. If the APEAT can be used to predict outcomes on the NPTE, students who do not meet standards for predicting success can be provided targeted instructional interventions to increase their NPTE success based on APEAT formative assessment and feedback. Improved programmatic outcomes improve program quality and impact social change.

Summary

This chapter has introduced the topics around this study. Upon graduation from a DPT program, students are required to pass the NPTE in order to become a licensed physical therapist in the United States. Programmatic outcomes, success, and accreditation are tied to student success on the NPTE. It is vital that DPT programs can predict which students may need remediation to be successful on the NPTE. The APEAT is one tool that has recently been adopted by many DPT programs. However, the literature is sparse and conflicting regarding the predictive relationship between the APEAT, DPT program GPA, and success on the NPTE. This study used a correlational

design with logistic regression to determine whether there is a predictive relationship between the variables.

   In Chapter 2, I examine the literature around the three variables: APEAT, DPT program GPA, and success on the NPTE. Recent studies on factors that predict success on the NPTE will be reviewed. The search strategy will be described, and more detail will be provided on the LOA theory, which is the theoretical foundation for this study.

Chapter 2: Literature Review

The problem addressed by this study was the decrease in success on the NPTE within the United States that a particular DPT program in the southeastern United States was trying to counteract with better preparation, such as administering the APEAT as a formative assessment. However, there is a gap in understanding the practical application and relationship between the APEAT as a formative assessment, GPA in the DPT program, and NPTE success. The purpose of this study was to determine the predictive power of a formative assessment and course assessments on performance on the national licensure examination of physical therapy students in the DPT program of a local university in the southeastern United States.

Researchers have investigated factors that predict success on the NPTE, but the APEAT has not been included as a variable in the studies (Bayliss et al., 2017; Clark & Chiu, 2019; Cook et al., 2015; Kume et al., 2019; Roman & Buman, 2019). Factors related to the program, the student, and coursework have been studied (Clark & Chiu, 2019; Coleman-Salgado & Barakatt, 2018; Cook et al., 2015; Huhn & Parrott, 2017). Minimal research has been conducted on the APEAT as a formative assessment that may predict success on the summative NPTE.

Within the studies that mention the APEAT, there are conflicting results regarding the correlation between a passing score on the APEAT and passing the NPTE (Crawley et al., 2015; FSBPT, 2019; Michaels et al., 2019). The APEAT is used in DPT programs to prepare students for the summative NPTE (FSBPT, 2019). Even though the APEAT is

used, there is a lack of research on the correlation between the APEAT as a formative

assessment, DPT program GPA, and NPTE success.

This chapter will highlight the literature search strategy used. LOA is the

theoretical foundation for the study and will be described in more detail. The literature

review will focus on the APEAT, DPT program GPA, and success on the NPTE. These

variables are described in more detail in this chapter, along with background information

on formative assessment and the role of formative assessment in learning. I also discuss

other allied health professions, such as nursing, occupational therapy, and physical

therapy assistant, to add breadth to the literature review.

Literature Search Strategy

During March, April, and May of 2020, I searched the following databases

through Walden University and the institution where I am employed: Education Source,

ERIC, Sage Journals, Science Direct, Taylor and Francis Online, CINAHL complete,

MedEd Portal, Allied Health Evidence, Sport Discus, and ProQuest Central. The

databases searched were identified as indexing educational and health sciences, in

particular physical therapy literature. The initial search terms centered on the variables

for this study: *APEAT*, *DPT program GPA*, and *NPTE success*. Other keywords used in

the literature search were *formative assessment, summative assessment,* and *academic

performance*. *Physical therapy* and *higher education* were used to narrow the focus of the

results to the physical therapy education literature. The literature search around the

variables was limited to the years 2015 to 2020.

Once relevant articles were retrieved, I reviewed the reference lists from those studies for any other related articles. Relevant articles were placed into Google Scholar to search for other works that cited the article. Those articles were reviewed for relevance and included, if appropriate. Three dissertations on similar topics were retrieved during the literature review. The reference lists from these dissertations were also reviewed, and relevant articles were included. Reviewing the dissertations did not provide any significant new references.

There is limited research in the past few years regarding factors that predict success on the NPTE. To ensure that the literature around the topic was thoroughly addressed, I expanded the search to include other health sciences such as nursing, occupational therapy, and prosthetics. Additionally, given that the APEAT is used as a formative assessment, I searched the literature regarding formative assessment in physical therapy and other health sciences, adding the keywords *formative assessment* and *assessment for learning*.

Theoretical Foundation

The theoretical foundation for this study was the LOA theory by Carless (2007). This theory stems from the confusion around formative assessment; what exactly is formative assessment, and how is it used. Carless (2007) postulated that assessment should emphasize the learning aspects of assessment. Assessment has two main purposes: it should evaluate student achievement, and it should provide a learning opportunity (Carless, 2007, 2015). When assessment is being used effectively, these two elements should overlap (Carless, 2007). LOA focuses on the learning aspect of assessment and

highlights the importance of learning within formative or summative assessments. For this study, I focused on the use of LOA within the context of formative assessment.

Traditionally, education has focused on assessment as a means of evaluating student performance regardless of summative or formative (Zeng et al., 2018). This is called assessment of learning. Assessment for learning and assessment as learning are two other relationships between assessment and learning. Assessment for learning occurs as a part of formative assessment (Black & Wiliam, 1998; Carless, 2007; Peeters, 2017). Assessment as learning occurs when students evaluate their work and is a higher level skill (Zeng et al., 2018). LOA primarily focuses on assessment for learning and assessment as learning, but also includes assessment of learning.

LOA has three principles: (a) assessment should stimulate learning, (b) assessment should include peer and/or self-reflection, and (c) feedback should be forward-looking to support learning (Carless, 2007). LOA is not specific to formative or summative assessment; the main emphasis of LOA is that learning should occur as a part of the assessment process (Carless, 2015). Inherent in the learning component of assessment is the need for feedback and student reflection. LOA is unique in that it balances assessment for learning, assessment of learning, and assessment as learning (Zeng et al., 2018).

LOA is a relatively new theory but has been used in studies in pharmacy education and molecular biology to frame formative assessment strategies (Peeters, 2017; Vanderlelie & Alexander, 2016). Peeters (2017) focused on assessment for learning in a pharmacy program through portfolios and entrustable professional activities. Both

activities described by the author included feedback for student development and improvement of learning within the pharmacy program. Vanderlelie and Alexander (2016) added formative assessments in the form of online quizzes to a molecular biology class. A formative midterm exam was also added to their course with detailed feedback sessions. Final course grades and performance on the final exam were improved after the implementation of the formative assessments as modeled by LOA (Vanderlelie & Alexander, 2016).

The APEAT has been used as a formative assessment. It is given online by the FSBPT towards the end of the DPT program. Students can immediately see their overall score, along with a breakdown of scores in individual content areas (FSBPT, 2019). The breakdown of scores is personal feedback to the student regarding performance on the formative assessment. The students can reflect on their strengths and weaknesses on the APEAT. The self-reflection allows the students to know where to focus studying for the summative NPTE that is taken after graduation from the DPT program.

The research question for this study is about the predictive ability of the APEAT and DPT program GPA on NPTE success. As described previously, the APEAT is a formative assessment. Feedback is provided, and students reflect on performance. This process models the LOA principles and theory. Using the LOA as the theoretical foundation for this study helped frame the data analysis of a formative assessment's potential to predict success on a summative assessment.

Literature Review Related to Key Concepts and Variable

In this literature review, I will focus on recent articles related to the primary construct of this study, which is the use of a summative assessment as a formative assessment. Research on the APEAT and DPT program GPA will be reviewed along with articles on NPTE success as the independent and dependent variables. Given the lack of literature connecting the APEAT, DPT program GPA, and NPTE success, I will also review recent articles related to licensure exam success in other allied health professions such as nursing, occupational therapy, and prosthetics.

Formative Assessment

Formative assessment has historically been a confusing topic for educators (Black & Wiliam, 1998). Black and Wiliam (1998) described formative assessment as any activity by the teacher and the students that are used as feedback to modify the learning activity. Carless (2015) refined Black and Wiliam's definition of formative assessment to focus on the learning aspects of assessment.

Effective assessment should include student learning (Carless, 2015). Formative assessment typically fills this role and includes learning as part of the process. There has been a shift in the literature towards both summative and formative assessment, enhancing student learning (Dixson & Worrell, 2016; Kulasegaram & Rangachari, 2018; Lau, 2016; Yang et al., 2019). With the increased workload on faculty in higher education, added grading and feedback could become burdensome. It is possible to utilize both formative and summative assessment in place of each other when done correctly and when aligned with the course learning outcomes (Dixson & Worrell, 2016; Kibble, 2017;

Kulasegaram & Rangachari, 2018; Oh et al., 2020; Otter et al., 2019). Given that the

APEAT is primarily used in DPT programs as a formative assessment that is derived

from a summative assessment, the use of summative assessments as formative

assessments will be the focus of this literature review.

Summative Assessment as a Formative Assessment

Summative assessments are typically used at the end of a unit or section of

learning to measure student learning and how well the student performs compared to a

standard (Dixson & Worrell, 2016; Kibble, 2017; Lau, 2016). Summative assessments

are high stakes because not only can a grade be involved, but qualification for specific

programs or professions can be dependent on the outcome of the summative assessment.

To help students prepare for summative assessments, formative assessments can be used

to provide feedback to the student on areas of strengths and deficiencies (Carless, 2015;

Jensen et al., 2017; Kulasegaram & Rangachari, 2018; Lau, 2016; Otter et al., 2019;

Watling & Ginsburg, 2019). The feedback the student receives is a crucial factor in

improving learning outcomes and future performance on summative assessments.

It has been shown that testing that provides the student with feedback is more

effective than merely restudying the information (Efu, 2019; Yang et al., 2019). Students

learn more and perform better on summative assessments when course content is tested

and feedback is provided to the student. Delayed feedback appears to be better for student

learning than immediate feedback as the student has to use their memory to remember the

thought process used for the questions on the exam (Yang et al., 2019). Efu (2019)

reported that immediate feedback was more effective during collaborative formative

assessments than delayed feedback. Regardless of when the feedback is provided, the more a student must think about why an answer was selected, the stronger the learning outcome.

Formative assessment can take many forms. For example, it can be a portfolio, an assignment, or a reflective journal (Broadbent et al., 2018; Deeley, 2018; Peeters, 2017). Deeley (2018) changed a reflective journal that is typically the summative assessment to a formative assessment with feedback to enhance student learning. She focused on assessment for learning rather than assessment of learning. She noted that this changed the relationship dynamic between the faculty and the student due to the interactions and conversations centered around feedback. Other researchers have applied the same approach to journaling in a large undergraduate class (Broadbent et al., 2018). Faculty were able to provide audio feedback and use exemplars methods of feedback to the large group of students. Delivering feedback in these ways helped to decrease the burden of grading; students worked iteratively on their journals towards the final summative submission (Broadbent et al., 2018).

Testing further enhances learning when it is spaced out over the length of the course rather than massed. A few questions each week are more effective than all of the questions at once (Yang et al., 2019). Interestingly the tests used for learning do not have to be the same format as the summative exam towards which the student is working (Yang et al., 2019). A short answer test as a formative assessment can improve outcomes on a multiple-choice summative assessment and vice versa. When using a test or

examination as a formative assessment, the key appears to be the repeated retrieval of the information from the student in a manner that is spread out, and feedback is provided.

Summative assessment can be used as a formative assessment as a test or in the form of other assignments. Traditionally, there has been the view that assessment is either summative or formative (Lau, 2016). However, there is an increased focus on student-centered learning, which has resulted in a shift towards improved use of formative assessments and using summative assessments as a formative assessment (Kulasegaram & Rangachari, 2018; Oh et al., 2020; Otter et al., 2019). To be used as a formative assessment, the summative assessment must be aligned with the learning outcomes, must include feedback, and must actively include the student in the learning process (Lau, 2016; McCallum & Milner, 2020; Nieminen et al., 2019; Xiao, 2017).

APEAT

The APEAT was developed by is administered by the FSBPT. A scaled score of 600 on the APEAT and the NPTE is considered passing on both exams. The maximum score possible is 800 (FSBPT, 2019). The APEAT consists of retired questions from the NPTE (FSBPT, 2020b). Because of this, it is a summative assessment that is being used as a formative assessment. The format of the questions, the timing of the exam, and the results provided to students are the same as for the NPTE. Using the APEAT as a formative assessment allows students to practice for the high-stakes NPTE. An essential aspect of the APEAT is the feedback that the students receive upon completion of the exam.

Upon completion, the student immediately receives a score report that is formatted the same as the score reports for the NPTE (FSBPT, 2020b). The feedback on the score report breaks down student performance into different categories that correlate with the content areas on the NPTE and the APEAT (FSBPT, 2020b). The content areas include professional work activities such as the physical therapy examination and interventions, and body systems are separated on the score report. Immediate feedback allows the student to self-reflect on performance (Gilliland & Wainwright, 2020; McCallum & Milner, 2020; Nieminen et al., 2019; Yang et al., 2019; Ziebart & MacDermid, 2019) and is an essential component of formative assessment and LOA (Carless, 2015). Within a DPT program, the goal of the APEAT is twofold: to provide students with practice for the high-stakes summative NPTE (Greene & Karavatas, 2018) and to provide feedback on strengths and weaknesses for improved performance on the NPTE (Crawley et al., 2015).

The FSBPT reported that scoring at least a 600 on the APEAT, which is considered passing, is strongly associated with a passing score on the NPTE (FSBPT, 2019). The peer-reviewed literature within physical therapy education that is available on the APEAT is sparse and conflicting. Crawley et al. (2015) reported no correlation between the APEAT and passing the NPTE. However, Michaels et al. (2019) reported a high correlation between APEAT scores and passing the NPTE, which is consistent with the FSBPT.

Crawley et al. (2015) used a survey given to graduates of a DPT program that asked questions about how the student prepared for the NPTE. Questions asked about

various preparatory tools such as review courses, review books, and practice exams. Study time in hours and days was also included in the survey (Crawley et al., 2015). The authors did not investigate scores on the NPTE simply if the student took the APEAT. In addition to the APEAT as a practice exam, other standardized exams from private companies were used by the students. Despite the lack of correlation between the APEAT and passing the NPTE, the authors recommend further investigations on the effect of various practice exams (i.e., formative assessments) on NPTE success (Crawley et al., 2015).

The FSBPT (2109) and Michaels et al. (2019) both reported a high correlation between APEAT and NPTE success. Neither article provided significant detail regarding the methods utilized to determine the relationship. Michaels et al. (2019) provided information about the APEAT correlating with the NPTE as background information for their study that looked at the language of questions on standardized examinations.

Some DPT programs have developed program-specific formative comprehensive examinations to prepare students for the NPTE. Utley et al. (2016) investigated the relationship between a program-specific comprehensive exam designed to mimic the NPTE and clinical performance; NPTE success was not a variable studied. Despite NPTE success not being included, the authors discussed the importance of formative assessments given towards the end of the DPT program. Recommendations for further research into standardized, comprehensive exams that are available to all DPT programs and can be used in a formative fashion was emphasized by the authors.

DPT Program GPA

The student's GPA at the end of the DPT program has been researched as a factor to predict NPTE success (Bayliss et al., 2017; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020). While the results have consistently shown that there is a correlation between the GPA at the end of the DPT program and NPTE success, most researchers concur that predicting NPTE success is multifactorial. Most of the studies have studied DPT program GPA in conjunction with other factors such as scores on the standardized Graduate Record Examination (GRE) (Bayliss et al., 2017; Hughes, 2019; Kume et al., 2019; Roman & Buman, 2019), undergraduate GPA (Fell et al., 2015; Roman & Buman, 2019), or student GPA at the end of the first year of the DPT program (Wolden et al., 2020).

When used in conjunction, DPT program GPA and GRE scores are predictive of success on the NPTE. DPT program GPA was the most predictive of success on the NPTE; however, adding verbal and quantitative subscores on the GRE improved the predictive relationship (Bayliss et al., 2017; Kume et al., 2019). Using the GRE verbal and quantitative subscores rather than the cumulative GRE score is a better predictor of success on the NPTE.

Slightly contradictory, Roman and Buman (2019) found that only the GPA at the end of the DPT program was predictive of NPTE success. GRE subscores on the verbal and quantitative sections did not improve the predictive relationship. Undergraduate GPA, along with the admissions interview, was predictive of DPT program GPA, but only DPT program GPA was predictive of NPTE success.

Undergraduate GPA, when correlated with DPT program GPA, has been shown to be predictive of NPTE success and DPT program success (Fell et al., 2015; Roman & Buman, 2019; Wolden et al., 2020). Undergraduate GPA is a factor that is reviewed upon application to the DPT program. NPTE success is multifactorial, and one variable alone should not be used to predict NPTE success (Wolden et al., 2020). Combining variables such as DPT program GPA, GRE subscores, and undergraduate GPA can improve the predictive ability for DPT programs to identify which students are more likely to be successful on the NPTE. DPT program GPA appears to be a consistent factor in the literature regarding NPTE success (see Bayliss et al., 2017; Fell et al., 2015; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020).

Licensure Exam Success in Allied Health

Physical therapy is part of the allied health professions, most of which require a licensure exam to practice in the United States. Success on licensure exams in other allied health professions will be discussed here to provide further background and comparison to factors that predict success on the NPTE.

Nursing

Nursing students must pass the National Council Licensure Examination for Registered Nurses (NCLEX-RN) to become a licensed registered nurse in the United States and Canada. Nursing programs are primarily baccalaureate degrees. Researchers in nursing education have investigated factors that predict success on the NCLEX-RN. Standardized examinations used as formative assessments, program GPA, and course grades have all been correlated with success on the NCLEX-RN (Doyle et al., 2019;

Johnson et al., 2017; Mathew & Aktan, 2018; McCloskey et al., 2019; Quinn et al., 2018).

Nursing program GPA had a positive correlation with success on the NCLEX-RN (Mathew & Aktan, 2018; McCloskey et al., 2019). Both admissions factors, such as scores on the Scholastic Aptitude Test (SAT) and academic factors such as GPA in the nursing program, have been examined to predict success on the NCLEX-RN (Mathew & Aktan, 2018). While GPA in all coursework was associated with success on the NCLEX-RN, GPA in the nursing coursework was more predictive of success. Standardized test scores on admissions test such as the SAT was also predictive of success (Mathew & Aktan, 2018; McCloskey et al., 2019). This is consistent with the DPT literature where DPT program GPA and GRE scores are predictive of success on the NPTE (see Bayliss et al., 2017; Kume et al., 2019).

The Health Education Systems Incorporated (HESI) exit exam has been used in nursing programs as a formative assessment to prepare students for the summative NCLEX-RN (Doyle et al., 2019; Gillespie & Nadeau, 2019; Johnson et al., 2017; Monroe & Dunemn, 2020; Quinn et al., 2018; Smith Glasgow et al., 2019). Students who performed well on the HESI exit exam in conjunction with completing the nursing program in sequence were more likely to be successful on the NCLEX-RN on the first attempt (Johnson et al., 2017). When the HESI as an exit exam was included as part of a course, similar outcomes were found as when the HESI was given on its own (Doyle et al., 2019). One of the most frequently used strategies in nursing programs to improve NCLEX-RN success was using a standardized exit exam such as the HESI (Quinn et al.,

2018). The HESI is used as a formative assessment to prepare the nursing students for the summative NCLEX-RN. The APEAT is a standardized formative assessment like the HESI that has been implemented towards the end of DPT programs, similar to an exit exam; however, there is limited research on the effectiveness of the APEAT.

Occupational Therapy

Occupational therapy may be one of the allied health professions that is most closely associated with physical therapy due to the therapeutic interventions offered by both professions. Many institutions that have physical therapy programs also have occupational therapy programs. However, the occupational therapy degree is often a master's degree compared to the doctoral degree that physical therapy programs confer. Despite the difference in the type of degree, both programs are graduate degree programs where a baccalaureate degree is a prerequisite. The occupational therapy licensure exam is called the National Board for Certification in Occupational Therapy (NBCOT) exam. Researchers have studied factors that may predict success on the NBCOT. The primary factors studied include program GPA and performance on standardized tests (Kurowski-Burt et al., 2020; Novalis et al., 2017; Zadnik et al., 2017).

GPA at the end of the occupational therapy program was predictive of success on the NBCOT (Novalis et al., 2017; Zadnik et al., 2017). As with studies in the DPT literature, the program GPA was not the only variable studied. Zadnik et al. (2017) used a mixed-methods approach to include focus groups that discussed preparation strategies for the NBCOT. Novalis et al. (2017) included writing scores from the interview process and altered schedules with the occupational therapy program as additional variables. If a

student had a lower writing score and was on an altered schedule within the occupational therapy program, the student would not be as successful on the NBCOT. Licensure exam success in occupational therapy appears to be multifactorial, just as in physical therapy.

The Occupational Therapy Knowledge Exam (OTKE) is similar to the APEAT in that it was developed by the organization that administers the NBCOT and is designed to be a formative assessment for students to prepare for the NBCOT (Kurowski-Burt et al., 2020). OTKE scores were used in the study by Kurowski-Burt et al. (2020) as a factor that may predict success on the NBCOT along with specific courses and performance on clinical fieldwork. While this is a different profession, the OKTE is similar to the APEAT and suggests that relationships between formative assessments and summative licensure exams should continue to be investigated.

Physical Therapy Assistant

Physical therapy assistants (PTAs) work alongside physical therapists, but the educational process to become a PTA is very different than that to become a DPT. PTAs receive associate degrees rather than doctorate degrees, but they still have to pass the PTAs version of the NPTE to obtain a license and practice in the United States (FSBPT, 2020a). Because the educational process is different, the variables that have been studied with PTA NPTE success are different than those studied in the literature for the DPT. The literature on PTAs success on the NPTE has focused on GPA for prerequisite courses, specific course grades, graduation rate, the for-profit status of the institution, and standardized tests such as American College Testing (ACT), Test of Essential Academic

Skills (TEAS), and Nelson Denny Reading Assessment (NDRA; Easley, 2016; Gresham et al., 2015; Kabiri et al., 2017).

Because PTAs education is an associate's degree, many PTA programs are housed in for-profit institutions (Gresham et al., 2015). While many studies that look at licensure exam success in allied health professions examine student variables, programmatic factors such as the number of cohorts admitted per year and for-profit status of the institution may have an impact on NPTE success. A negative correlation was found between the number of cohorts admitted per year and success on the PTA NPTE (Gresham et al., 2015). Additionally, if the institution was for-profit, there was a negative correlation with success on the PTA NPTE. If a student attends an institution that admits multiple cohorts per year and is for-profit, the student will be less likely to pass the PTA NPTE on the first attempt.

Standardized tests are predictive of success on the PTA NPTE (Easley, 2016; Kabiri et al., 2017). Higher scores on the ACT, TEAS, and NDRA were correlated with passing the PTA NPTE on the first attempt (Easley, 2016; Kabiri et al., 2017). Easley (2016) recommends further research on other standardized tests such as the HESI within PTA and DPT programs to determine the best predictors of student success. In addition to the ACT and TEAS, Kabiri et al. (2017) showed that prerequisite GPA and the student grade in anatomy and physiology were predictive of success on the PTA NPTE. The use of standardized tests as predictors of success in the PTA literature is consistent with what has been discussed in the DPT literature. As with DPT success on the NPTE, PTA

success is multifactorial, and one variable cannot be identified as the primary predictor of success on the PTA NPTE.

NPTE Success

NPTE success has been discussed previously in association with the APEAT and DPT program GPA. However, there are additional variables that may predict NPTE success. Pre-admission factors, standardized tests beyond the GRE, first-year DPT program GPA, and programmatic factors will be reviewed below.

Pre-admission Factors

Pre-admission factors are those variables that occur before the student is admitted to the DPT program. Undergraduate GPA has been described previously in this review as having a mixed correlation with success on the NPTE in conjunction with DPT program GPA (see Bayliss et al., 2017; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020). While the cumulative undergraduate GPA in conjunction with DPT program GPA is predictive of NPTE success, repeating prerequisite coursework does not have a relationship with DPT program GPA or NPTE success (Clark & Chiu, 2019). When eliminating DPT program GPA as a factor, all subscores on the GRE and the GPA for prerequisite courses were significantly associated with NPTE success (Coleman-Salgado & Barakatt, 2018; Meiners & Rush, 2017). Although not within the United States, an Australian study found that undergraduate GPA did not predict clinical performance in a physical therapy program (Terry et al., 2018).

Other Standardized Tests

Some DPT programs have implemented standardized tests that are not specifically related to physical therapy content to help predict NPTE success (Bliss & Jacobson, 2020; Carp et al., 2020; Huhn & Parrott, 2017; Huhn et al., 2018). The Health Sciences Reasoning Test (HSRT) is a standardized test that measures clinical reasoning skills for a variety of allied health professions (Huhn & Parrott, 2017). A moderate relationship was found between the HSRT and NPTE success; the significance improved when undergraduate GPA and GRE scores were added to the model (Huhn & Parrott, 2017). The Grit Scale score was studied by Carp et al. (2020). Grit is perseverance and the ability to work towards long-term goals (Bazelais et al., 2016). An increased score on the Grit Scale was associated with increased success on the NPTE (Carp et al., 2020). Despite the higher Grit Score also being associated with a higher DPT program GPA, when analyzing the DPT program GPA alone in relationship to NPTE success, there was no relationship between DPT program GPA and NPTE success (Carp et al., 2020). This is contradictory to previously discussed studies that reported a relationship between DPT program GPA and NPTE success (see Bayliss et al., 2017; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020).

First Year DPT Program GPA

The final GPA at the end of the DPT program has been discussed previously (see Bayliss et al., 2017; Carp et al., 2020; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020). GPA at the end of the first year of the DPT program has been studied as a factor that may predict success on the NPTE (Huhn & Parrott, 2017; Meiners

& Rush, 2017; Wolden et al., 2020). However, as with most other studies, the first-year DPT program GPA was studied in conjunction with other variables. First-year DPT program GPA was correlated with the HSRT as well as undergraduate GPA and GRE scores, and including all four factors were most predictive of NPTE success (Huhn & Parrott, 2017). GPA after the first year of the DPT program when studied with undergraduate GPA, verbal GRE subscore, and quantitative GRE subscore is most predictive of NPTE success (Meiners & Rush, 2017). The conclusion from a meta-analysis was that both first and third-year (final) DPT program GPA are predictive of success on the NPTE (Wolden et al., 2020). NPTE success continues to be multifactorial.

Program Factors

To this point, the discussion has focused on student factors; however, the effect of program factors on NPTE success should also be considered (Cook et al., 2015; Covington et al., 2016; Reilly et al., 2020; Roller et al., 2018). DPT programs that had a 100% pass rate on the first attempt had three things in common. The program spent more money on personnel per student, the program spent more money in general per student, and there were more full-time faculty per student (Covington et al., 2016). Specific courses within a DPT program are not predictive of success on the NPTE (Roller et al., 2018). Despite looking at multiple program factors such as student composition, clinical education length and design, and overall program length and design, the only factors that showed a statistically significant relationship with NPTE success was the overall DPT program GPA and a younger average age of the cohort at graduation (Cook et al., 2015). The significance of the DPT program GPA is consistent with previously discussed studies

(see Bayliss et al., 2017; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020).

Summary and Conclusions

A review of contemporary literature regarding NPTE success reveals that predicting success on the NPTE is multifactorial. All the studies reviewed included multiple factors, and most were not able to isolate one variable as a predictor of success on the NPTE. One consistent theme is that GPA is a significant factor in predicting NPTE success. Both DPT program GPA and undergraduate GPA are predictive of NPTE success (Bayliss et al., 2017; Coleman-Salgado & Barakatt, 2018; Kume et al., 2019; Meiners & Rush, 2017; Roman & Buman, 2019; Wolden et al., 2020).

Other allied health professions also use program GPA as a predictor of success on the licensure exams for the various professions (Doyle et al., 2019; Johnson et al., 2017; Kurowski-Burt et al., 2020; Mathew & Aktan, 2018; McCloskey et al., 2019; Novalis et al., 2017; Quinn et al., 2018; Zadnik et al., 2017). One difference between the literature on other allied health professions and the physical therapy literature is that other allied health professions include standardized examinations as formative assessments in their studies that look for predictive relationships for licensure success (Doyle et al., 2019; Johnson et al., 2017; Kurowski-Burt et al., 2020; Quinn et al., 2018). Occupational therapy uses the OTKE (Kurowski-Burt et al., 2020), while nursing uses the HESI exit exam (Doyle et al., 2019; Johnson et al., 2017; Quinn et al., 2018) along with program GPA to predict success on their respective licensure exams. Standardized exams have been used in physical therapy to predict success on the NPTE, but they are not used as

formative assessments to prepare students for the summative NPTE (Carp et al., 2020; Huhn & Parrott, 2017). There are no studies in the physical therapy education literature that correlate the APEAT as a formative assessment with DPT program GPA to predict NPTE success.

This dissertation addressed a gap in practice based on a gap in the literature regarding curricular and FSBPT recommended predictors of success on the NPTE (Crawley et al., 2015; FSBPT, 2019; Michaels et al., 2019). It provides an original contribution to the practice of physical therapy education by adding to what is known about predictors of NPTE success at a local site. This study examined the use of a formative assessment (APEAT) and DPT program GPA as predictors of NPTE success, which is a summative assessment for licensure. At the local site, this study permits administrators to use the formative APEAT with new fidelity for predicting success on the NPTE. This specific application is essential, given a recent decrease in first-time pass rates on the NPTE.

This study will benefit physical therapy students, educators, and programs by adding to what is known about variables that predict success on the NPTE. Increasing NPTE scores and passing rates may improve programmatic outcomes that are required by accrediting agencies. At the local site, it is essential to know how NPTE pass rates can be improved. If the APEAT can be used to predict outcomes on the NPTE, students who do not meet standards for predicting success can be provided targeted instructional interventions to increase their NPTE success based on APEAT formative assessment and feedback.

This study used a correlational design with logistic regression to determine the predictive relationship between the variables. The logistic regression model has been used in other studies in allied health professions to predict relationships for licensure success. The next chapter will provide more details regarding the study design, methodology, and proposed statistical analysis.

Chapter 3: Research Method

The purpose of this study was to determine the predictive power of a formative assessment and course assessments on success on the national licensure examination of physical therapy students in the DPT program of a local university in the southeastern United States. This study explored the predictive relationship between the APEAT scores and GPA in the DPT program and success on the NPTE. In this chapter, I will describe the research design and rationale, along with the methodology. Within the methodology, I will describe the population, sampling procedure, archival data, operational constructs, and the data analysis plan. Threats to validity and ethical procedures will also be described.

Research Design and Rationale

The independent variables were the APEAT scores and the DPT program GPA. These are the variables that were measured within the student. The two independent variables are measured as a continuous data set. The dependent variable was success on the NPTE. The NPTE was measured categorically as a dichotomous variable (Curtis et al., 2016). It was categorized as a "yes" the student was successful or "no" the student was not successful on the NPTE.

This study was quantitative, nonexperimental, and correlational, as it involved analysis of retrospective data (see Seeram, 2019). Its objective was to determine a predictive relationship between the independent and dependent variables. A correlational design was appropriate for this study because the independent variables cannot be manipulated (Curtis et al., 2016); that is, APEAT scores and GPA cannot change. Within

the correlational research design, this study was further refined to determine a predictive

relationship between APEAT and DPT program GPA and NPTE success. A correlational

design for this study was consistent with other studies conducted in allied health

education that use formative assessments to predict success on summative licensure

exams (see Kurowski-Burt et al., 2020; Novalis et al., 2017; Zadnik et al., 2017).

Methodology

This section will include details on the population, sampling procedure, archival

data, operational constructs, and the plan for data analysis.

Population Selection

The population for this study was DPT students who graduated from the DPT

program at the local site from the summer of 2019 through the summer of 2020. The

summer of 2019 was selected as the starting point because that was the first cohort of

students who took the APEAT as a formative assessment at the local site. I used a total of

four cohorts of students for this study. Each cohort has approximately 50 students, which

yielded 214 DPT students for whom data were analyzed.

Sampling and Sampling Procedures

A census was used from the local site. As previously stated, the students who

graduated in the summer of 2019 were the first cohort to use the APEAT as a formative

assessment. The DPT program asks all students to release their NPTE results to the DPT

program. Most students are compliant with this request. However, not all students release

their NPTE result to the DPT program; data from those students who do not release

NPTE scores were not included in this study. Binomial logistic regression requires at

least 50 cases per independent variable (Laerd Statistics, 2017); the census for this study yielded close to 200 cases per independent variable. A priori power analysis using G*Power identified the need for at least 134 cases; power was set to .80, the probability for H_A was estimated at .9 and .6 for H_0. R^2 was estimated at .81, and α was set to .05 (Faul et al., 2009).

Archival Data

I used archival data from the local site for this study. The local site maintains student records that include the APEAT score, DPT program GPA, and NPTE success. Only the APEAT score, DPT program GPA, and NPTE success as a yes/no were retrieved from the student record. An administrative assistant with access to the data was able to de-identify the data before providing it for this study. Before proposing this study, I received permission from program administrators at the local site to access the archival student data pending appropriate approval from the IRB at Walden University and the local site.

Operationalization of Constructs

APEAT scores and DPT program GPA are the independent variables. The dependent variable is NPTE success as a yes/no (pass/fail). The APEAT was developed by and is administered by the FSBPT. A scaled score of 600 on the APEAT and the NPTE is considered passing on both exams. The maximum score possible is 800 (FSBPT, 2019). The APEAT consists of retired questions from the NPTE (FSBPT, 2020b). The student receives a score based on the number of questions answered

correctly. The APEAT scores are a discrete variable from 0 to 800 measured as whole numbers. It will be used as a ratio-scale variable.

DPT program GPA was calculated by the registrar's office at the local site. It is calculated on a 4.0 scale where and A is 4.0, B+ is 3.5, B is 3.0, C+ is 2.5, etc., down to an F as 0.0. It is a continuous variable from 0.0 to 4.0, which I used as a ratio-scale variable. All coursework in the DPT program is included in the DPT program GPA except for clinical courses that are graded as a pass/fail and do not receive a letter grade. According to the program director, students who fail a course are dismissed from the program; dismissal from the program typically occurs in the first year of the program. Students dismissed in the first year of the program did impact the sample size for this study because the APEAT is given in the third year of the DPT program; only students who have completed the APEAT were included in this study.

The NPTE is a standardized national exam administered by the FSBPT. Passing the NPTE allows a graduate of the DPT program to become a licensed physical therapist in the United States. The NPTE is scored like the APEAT; a scaled score of 600 out of 800 is considered passing. For this study, NPTE success was used as a dichotomous variable where yes is passing and no is failing the first attempt of the NPTE. This is consistent with studies in other allied health professions that have looked at licensure exam success (see Kurowski-Burt et al., 2020; Novalis et al., 2017; Zadnik et al., 2017).

Data Analysis Plan

Data were analyzed using IBM SPSS (Version 26). Three assumptions that must be tested when using a binomial logistic regression are that (a) there is a linear

relationship between the independent and dependent variables, (b) there is no multicollinearity in the data, and (c) there are no significant outliers. I used the Box-Tidewell approach to test for a linear relationship, an inspection of correlation coefficients to test for multicollinearity, and casewise diagnostics to detect outliers (see Laerd Statistics, 2017).

There is one research question to determine the predictive relationship between APEAT scores, DPT Program GPA, and success on the NPTE.

RQ: To what extent do APEAT scores and DPT program GPA predict NPTE success of DPT students?

H_0: APEAT scores and DPT program GPA are not significant predictors for NPTE success of DPT students.

H_A: APEAT scores and DPT program GPA are significant predictors for NPTE success of DPT students.

Binomial logistic regression was used to determine the predictive relationship between the independent variables that are continuous variables, and the dependent variable, which is a dichotomous variable. I assessed the model fit using the Hosmer and Lemeshow goodness of fit test and explained variance with the Nagelkerke R^2 (see Laerd Statistics, 2017). The Wald test was used to determine the statistical significance of the independent variables. The level of significance for all statistical tests was set at .05, and the confidence interval was set at 95%; this is similar to other studies conducted in allied health that study licensure exam success (see Bayliss et al., 2017; Kume et al., 2019; Mathew & Aktan, 2018; Monroe & Dunemn, 2020; Zadnik et al., 2017).

Threats to Validity

External Validity

The primary threat to external validity is that the results of this study will not be generalizable to all DPT programs. The results of this study will only be relevant to the DPT program at the local site. Each DPT program has a different curriculum, which will result in different DPT program GPA as well as various means of preparing students for the APEAT and the NPTE. Another threat to external validity is that if the NPTE changes formats or has a significant change in content, the results of this study will not be valid. If the NPTE were to change, this study would need to be repeated with the new version of the NPTE.

Internal Validity

Internal validity is threatened in this study by the possibility of repeated testing. The DPT students have access to two other versions of the APEAT. The questions on the other two versions are not retired NPTE questions, rather questions that are similar in style, format, and content to the NPTE. The students also may utilize other NPTE preparation tools, such as other formative examinations from proprietary companies that specialize in NPTE preparation as part of review courses. It is not possible to limit the number of board preparation examinations or resources that the students used or to know how many board preparation examinations the students used. Therefore, the results of this study should be interpreted with caution. It may be appropriate to repeat this study without archival data to include survey questions to the students about other NPTE preparation resources used.

Ethical Procedures

Approval was obtained from the IRB (10-21-20-0746886) from Walden

University and the local site. Data used in this study were archived in the student records

held at the local site. I obtained preliminary permission to conduct this study and access

student data, pending IRB approval, from administrators at the local site. The Office of

Assessment and Institutional Research at the local site collects student GPA data and

NPTE success data. APEAT scores are collected by the instructor who teaches the course

where the APEAT is administered. The instructor provided the APEAT scores to the

Office of Assessment and Institutional Research so that all data could be de-identified

and compiled into one file. Once the Office of Assessment and Institutional Research at

the local site had de-identified and organized the data into a single file, the compiled data

were shared with me through a secure email. I, and the Office of Assessment and

Institutional Research, will keep the data files on employer-issued computers that are

password protected to ensure secure storage of the data. Raw data will be available to the

committee upon request. Data will be destroyed 5 years after the completion of this study.

Summary

This chapter provided an overview of the research design and methodology. This

study was quantitative, nonexperimental, and correlational, as analyzed retrospective data

(Seeram, 2019). It attempted to determine a predictive relationship between the

independent and dependent variables. Binomial logistic regression was used to analyze

the archival data. The independent variables were operationally defined, as was the

dependent variable. The independent variables are APEAT scores and DPT program GPA, and the dependent variable is NPTE success.

   The results of the study will be presented in the next chapter. I will provide further detail regarding the statistical analyses and the results from each analysis. Figures and tables will be used as appropriate to display and organize the results.

Chapter 4: Results

The purpose of this study was to determine the predictive power of a formative assessment (i.e., APEAT) and course assessments (i.e., DPT program GPA) on success on the national licensure examination of physical therapy students in the DPT program of a university in the southeastern United States. The single research question sought to determine the extent to which APEAT scores and DPT program GPA predict NPTE success of DPT students. The null hypothesis was that there would be no statistical relationship between APEAT scores, DPT program GPA, and NPTE success of DPT students.

In this chapter, I describe how the data were collected and analyzed. I present the descriptive and demographic characteristics of the sample. The results of the data analysis are presented. Tables and figures are used to present the results along with narrative descriptions in accordance with American Psychological Association (APA) and accepted standards for reporting of statistical outcomes.

Data Collection

Archived data from the local site were used for this study. An administrative assistant with access to student records provided me with APEAT scores, DPT program GPA, and NPTE success as a yes (passed) or no (failed) measure for four cohorts of students. The data were presented to me in a Microsoft Excel file and deidentified by removing names and student ID numbers. The students who graduated in summer 2019, fall 2019, spring 2020, and summer 2020 were included in this study. The total number of students in all four cohorts was 214. Data records were available for 209 of those

students. The most likely reason for missing data for five students was that not all

students release their NPTE scores to the DPT program. In addition, not all students take

the NPTE upon graduation. Thus, the census sample of 209 cases was used for data

analysis. The census sample's demographic characteristics revealed that 61.2% of the

sample were female and 38.8% male. The average age of the students at the time of

taking the NPTE was 26.9 years old.

Data Analysis

I analyzed the data using IBM SPSS 26. The Box-Tidewell approach was used to

test for a linear relationship, correlation of coefficients was used to test for multi-

collinearity, and casewise diagnostics were used to detect any outliers (Laerd Statistics,

2017). Binomial logistic regression was used to determine the predictive relationship

between the independent variables and the dichotomous dependent variable. Hosmer and

Lemeshow goodness of fit test was used for model fit, and Nagelkerke R^2 was used to

analyze variance (Laerd Statistics, 2017).

Results

Descriptive Statistics

Of the 209 cases analyzed, 181 were successful on the NPTE, and 28 were not

successful on the NPTE. The mean score on the APEAT was 571, and the mean GPA at

the end of the DPT program was 3.46. Table 1 presents the descriptive statistics for

APEAT scores and DPT program GPA.

Table 1

Descriptive Statistics

Variable	*N*	Minimum	Maximum	*M*	*SD*
APEAT scores	209	379	703	571.01	51.18
DPT program GPA	209	2.47	3.96	3.46	0.26

Binomial Logistic Regression

I performed a binomial logistic regression to ascertain the effects of APEAT scores and DPT program GPA on NPTE success. The linearity of the continuous variables with respect to the logit of the dependent variable was assessed using the Box-Tidwell procedure (Box & Tidwell, 1962). A Bonferroni correction was applied using all four terms in the model, resulting in statistical significance being accepted when $p <$ .0125 (Tabachnick & Fidell, 2014). Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. Casewise diagnostics showed that there were two standardized residuals with values of -2.62 and -2.60 standard deviations. Because they were close to the cut off of 2.5, they were kept in the analysis. The area under the Receiver Operating Characteristic (ROC) curve was .84 (95% CI, .76 to .92), which is an excellent level of discrimination, according to Hosmer et al. (2013). Figure 1 shows the area under the ROC curve.

Figure 1

Area under Receiver Operating Characteristic (ROC) Curve
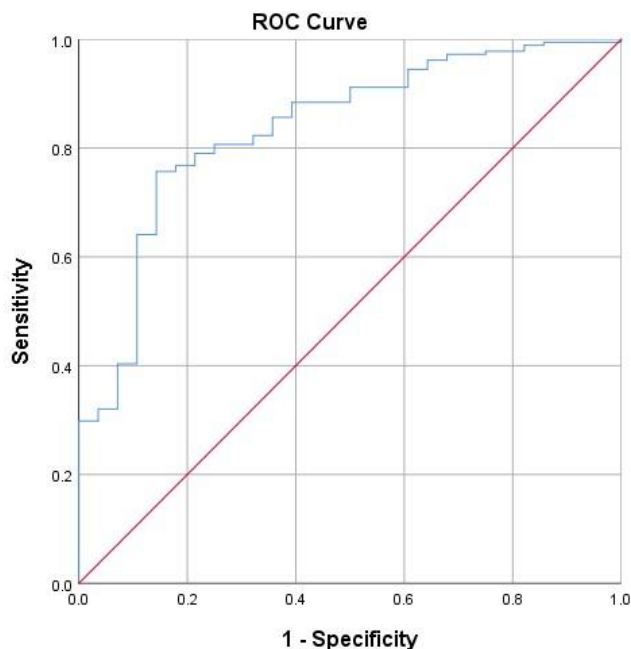
The logistic regression model was statistically significant, $\chi^2(2) = 38.71$, $p <$ .0005. The statistically significant logistic regression resulted in the rejection of the null hypothesis of no predictive relationship between APEAT scores and DPT program GPA on NPTE success. The model explained 31.0% (Nagelkerke R^2) of the variance in NPTE success and correctly classified 88.0% of cases. Sensitivity was 98.9%, specificity was 17.9%, positive predictive value was 88.6%, and the negative predictive value was 71.4%. The Wald test for statistical significance showed that both predictor variables were statistically significant (see Table 2). Increasing APEAT scores and increasing GPA were each associated with an increased likelihood of success on the NPTE. The adjusted

odds ratio for APEAT scores was 1.01, 95% CI [1.00, 1.03], which indicates a weak

relationship between APEAT scores and NPTE success. However, GPA had a strong

relationship with NPTE success because increasing GPA by 1 point was associated with

35.77, 95% CI [4.44, 288.20] times higher odds of NPTE success. The 95% CI for GPA

was 4.44 to 288.20, which indicated a less precise estimate of the adjusted odds ratio for

GPA.

Table 2

Predicting NPTE Success: Results from Binomial Logistic Regression

							Adjusted odds ratio	
							95% *CI*	
	B	*SE*	Wald	*df*	*p*	*AOR*	Lower	Upper
APEAT scores	0.01	.006	5.94	1	.015	1.01	1.00	1.03
GPA	3.58	1.07	11.29	1	.001	35.77	4.44	288.20
Constant	-17.55	3.68	22.70	1	.000	.000		

Summary

The null hypothesis of no predictive relationship between APEAT performance

and DPT program GPA on NPTE success was rejected. APEAT scores and DPT program

GPA were both predictive of NPTE success. APEAT scores had a weak relationship with

NPTE success based on the adjusted odds ratio. DPT program GPA had a stronger

predictive relationship with NPTE success. The model for the binomial logistic

regression met appropriate assumptions and was statistically significant.

In the next chapter, I will interpret the results described above. Carless's (2007)

LOA theory will be used to frame the interpretation. The results will be compared to what

is known from the current literature regarding the use of the APEAT and GPA to predict

NPTE success. Limitations of the study will be discussed, and recommendations will be provided for future research. Implications for social change, as well as implications for practical implication in physical therapy education, will be postulated upon.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to determine the predictive power of the APEAT, as a formative assessment, and DPT program GPA on success on the national licensure examination of physical therapy students in the DPT program of one university in the southeastern United States. The quantitative, correlational study was conducted to determine how well the APEAT and DPT program GPA predict success on the NPTE. The APEAT has been implemented at the local site as a formative assessment to prepare for the summative NPTE; however, there is a paucity of literature describing the relationship between the APEAT and the NPTE.

Binomial logistic regression indicated that both APEAT scores and DPT program GPA are predictive of success on the NPTE. The logistic model was statistically significant. APEAT scores are weakly predictive of success on the NPTE. DPT program GPA is strongly predictive but less precise based on the large range in the 95% CI.

Interpretation of the Findings

The problem addressed in this study was the decrease in success on the NPTE at the local site, a DPT program in the southeastern United States. The local site had implemented the APEAT as a formative assessment to prepare students for the summative national licensure exam. The results of this study indicate that there is a weak predictive relationship between APEAT scores and NPTE success; this can help the local site identify students who may not be successful on the NPTE. DPT program GPA has a stronger predictive relationship with NPTE success, and it would be better for the local site to use both APEAT scores and DPT program GPA to predict which students will be

successful on the NPTE. A higher score on the APEAT along with a higher DPT program GPA has a strong predictive relationship to success on the NPTE.

The research question for this study was to what extent do APEAT scores, and DPT program GPA predict NPTE success of DPT students. The null hypothesis was rejected given that the model had a good fit and was statistically significant to show that APEAT scores and DPT program GPA were predictive of NPTE success. APEAT scores had a weak relationship with NPTE success based on the adjusted odds ratio. DPT program GPA had a stronger predictive relationship with NPTE success. The binomial logistic regression met appropriate assumptions and was statistically significant.

Theoretical Framework

The results of this study can be interpreted within Carless's (2007) LOA theory, which was the theoretical framework for this study. LOA postulates that assessment should emphasize the learning components of assessment. The APEAT was used as a formative assessment that stimulates learning and reflection to improve performance on the summative NPTE. The significant, even though weak, predictive relationship of APEAT scores on NPTE success aligns with LOA theory. Students who performed better on the APEAT were successful on the NPTE. Apparently, students reflected on the results from the APEAT and utilized the feedback to improve success on the NPTE.

Formative Assessment

The APEAT was used by the local site as a formative assessment. To help students prepare for summative assessments, formative assessments can be used to provide feedback to the student on areas of strengths and deficiencies (Carless, 2015;

Jensen et al., 2017; Kulasegaram & Rangachari, 2018; Lau, 2016; Otter et al., 2019;

Watling & Ginsburg, 2019). The APEAT is derived from a summative assessment,

retired NPTE questions, but is used as a formative assessment. The APEAT supports

LOA as it stimulates learning, includes self-reflection, and supports learning by being

forward-looking (Carless, 2007). The individual results from the APEAT can be used to

enhance student learning and perhaps improve performance on summative assessments.

The APEAT is aligned with learning outcomes, provides feedback, and actively engages

the student in the learning process (Lau, 2016; McCallum & Milner, 2020; Nieminen et

al., 2019; Xiao, 2017).

In the physical therapy education literature, the use of APEAT as a predictor of

success on the NPTE is sparse and conflicting (Crawley et al., 2015; FSBPT, 2019;

Michaels et al., 2019). The results from this study are consistent with Michaels et al.

(2019) and the FSBPT (2019). Both Michaels et al. and the FSBPT reported strong

predictive relationships between APEAT scores and NPTE. While statistically

significant, the predictive relationship in this study between APEAT scores and NPTE

success was weak. FSBPT used APEAT scores and NPTE scores as continuous variables,

which may account for the stronger relationship. It is unclear how Crawley et al. (2015)

or Michaels et al. measured the variables used in their studies.

DPT Program GPA

DPT program GPA can be viewed as a summative assessment for each course

within the DPT program but also formative towards the summative national licensure

exam. Using it as a formative assessment within the LOA theory, the student uses the

grades and GPA to reflect on strengths and weaknesses and uses feedback from instructors to continue to improve performance. DPT program GPA was strongly predictive of NPTE success, which fits with Carless's (2007) theory that formative assessment can provide learning opportunities for students. Applying LOA to formative assessment has shown to improve summative assessment (Peeters, 2017; Vanderlelie & Alexander, 2016).

DPT program GPA has consistently been shown to be a strong predictor of NPTE in the physical therapy education literature (see Bayliss et al., 2017; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020). The results of this study are consistent with what has been reported in the literature. The strong predictive relationship between the DPT program GPA and NPTE success is logical because DPT programs must follow specific standards of accreditation that are designed to educate physical therapy students and promote success on the national licensure exam (Commission on Accreditation in Physical Therapy Education, 2019).

NPTE Success

This study is consistent with the literature that states that NPTE success is multifactorial (see Bayliss et al., 2017; Carp et al., 2020; Clark & Chiu, 2019, 2019; Coleman-Salgado & Barakatt, 2018; Cook et al., 2015; Crawley et al., 2015; Huhn & Parrott, 2017; Mitchell et al., 2019; Roller et al., 2018; Roman & Buman, 2019; Utley et al., 2016; Wolden et al., 2020). This is the first study that I am aware of that studied APEAT scores and DPT program GPA as predictors of success on the NPTE. Other studies have looked at the relationship of various standardized exams on NPTE success

(see Bliss & Jacobson, 2020; Carp et al., 2020; Huhn & Parrott, 2017). However, none have studied the predictive relationship of APEAT scores and DPT program GPA on NPTE success. The results of this study indicate that there is a predictive relationship between APEAT score and DPT program GPA and DPT student success on the NPTE.

Limitations of the Study

The most significant limitation of this study is that it is not generalizable to all DPT students and DPT programs. The data analyzed were from one DPT program. All DPT programs in the United States are accredited by the same accrediting body and must meet the same accreditation standards (Commission on Accreditation in Physical Therapy Education, 2019); however, exactly how each program meets the standards is different. The difference in methods of achieving accreditation standards results in different curricula, which will impact the DPT program GPA. The different curricula may also impact the knowledge of each student, which in turn can impact the scores on the APEAT.

Another limitation of this study is the unknown effect of repeated testing. The APEAT is not the only practice examination available to students. As students prepare for the NPTE, they will use multiple practice examinations. These practice examinations are available from FSBPT as well as other agencies that offer licensure examination preparation. The weak predictive power of the APEAT may be due to repeated testing, and the use of other types of practice examinations.

A third limitation of the study is that the dependent variable, NPTE success, was used as a dichotomous variable. The data available from the local site did not include the

actual NPTE score for all students; as a result, the decision was made to use success as yes/no, rather than the numerical score on the NPTE. The dichotomous dependent variable allowed me to determine a categorical relationship for the predictor variables but did not allow me to determine specific numbers that are predictive of specific scores on the NPTE.

Recommendations

Future studies could explore similar research questions but with larger and more diverse samples. Using student data from multiple DPT programs would help generalize the results. The results from this study regarding DPT program GPA are consistent with the literature (see Bayliss et al., 2017; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020). However, the weak association between APEAT scores and NPTE success is contradictory to data reported by the FSBPT (2019). Further research could be conducted using the APEAT and other variations of practice examinations. This type of research would help to address the effects of repeated testing. In addition, the correlation between APEAT scores and DPT program GPA could be studied. Future research could use NPTE scores as a continuous dependent variable rather than dichotomous as was used in this study. Using NPTE scores as a continuous variable would allow future researchers to determine a more specific predictive relationship between APEAT scores, DPT program GPA, and NPTE scores.

Implications

The significant results achieved in this study will help to address the gap in practice regarding the use of the APEAT and DPT program GPA as predictors of NPTE

success at the local level. The weak predictive relationship of the APEAT scores will help the local DPT program know that, although the APEAT is important, it is not the only predictor of success on the NPTE. DPT program GPA is a stronger predictor of NPTE success, which is consistent with the current physical therapy education literature (see Bayliss et al., 2017; Kume et al., 2019; Roman & Buman, 2019; Wolden et al., 2020).

Recognizing factors that predict success on the NPTE allows DPT programs to identify students who may need remediation. Targeted instructional interventions to increase NPTE success can be implemented for appropriate students. This will improve programmatic outcomes. Improved programmatic outcomes improve program quality and impact social change.

<p style="text-align:center">Conclusion</p>

Programmatic outcomes and accreditation are tied to student success on the NPTE. It is vital that DPT programs be able to predict which students may need remediation to be successful on the NPTE. The APEAT is a tool that has been used by many DPT programs but has not been well studied in the physical therapy education literature. The statistically significant results from this study will add to the physical therapy education literature by confirming the use of the APEAT as a valuable formative assessment for NTPE preparation. In combination with DPT program GPA, the APEAT can help to predict which students will be successful on the NPTE.

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