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Analyzing Carroll's Model of School Learning, Degree of Learning, in Adult Basic Education

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by

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Abstract

This study examined Carroll's Model of School Learning (MSL) on adult basic education (ABE). The study's central question was, "Does Carroll's MSL account for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age?" A non-experimental cross-sectional design was employed to explore the fiscal year 2019–2020 dataset (n=99) from Arkansas ABE centers to show how instructional time and MSL account for variation in adults' post-test reading scores. Hierarchical linear regression analyses were run to predict the correlation between MSL and the Test of Adult Basic Education (TABE) Reading score. The results show that MSL is not significantly correlated to the TABE Reading score. Further investigation was conducted on the relationship between the five constructs of MSL (time allocated for learning, perseverance, aptitude, quality of instruction, and the ability to understand instruction) and TABE 11 & 12 Reading post-test scores. Based on an adapted MSL framework, findings suggested that the adult learner's ability to understand instruction predicted the TABE Reading post-test score. Implications for the research community include being aware of opportunities for further research and support for policy change in ABE.

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Dedication

I dedicate this to my wife, Rochelle Kelly, DNP, who is always there for me, even on tough days.

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Chapter One: Introduction

Without a high school equivalency diploma, adults have a barrier to upward mobility, including entrance into post-secondary enrollment and job attainment or advancement. When an adult learner decides to pursue their high school equivalency diploma at an adult education program, their final grade level completed is not considered for placement when enrolling. I see the need to explore a different method to determine when a person is ready to qualify to take their general educational development test. This is based on my observations from two adult education programs after seeing hundreds of people not complete their adult basic education.

The current process for enrollment in adult basic education (ABE) starts with an assessment of the adult learner's level of understanding. Data Recognition Corporation (DRC) is the publisher of the Test of Adult Basic Education (TABE). DRC offers a level of understanding placement test titled, Locator. Once the Locator is taken, a five-level outcome score will be produced. The five-level outcome score determines which TABE test should be administered for enrolling in the ABE program. Arkansas ABE programs must complete the intake assessment within 12 hours of enrollment. Once the adult learner has enrolled for 12 hours, the federal oversight for adult learner performance becomes reportable between local programs, states, and the federal government. Once minimum hours are obtained, ABE programs are guided to complete a post-test in DRC. A score of 535 out of 800 on TABE is required before the general educational development (GED®) testing series can begin. If, for some reason, a minimum score is not reached (535), the testing cycle repeats (attend for 40 hours at a minimum before reattempting a minimum TABE score). The minimum score on TABE becomes a gateway to the GED®. The adult learner can take the GED® practice test (GED Ready®) once the 535 in TABE is earned. In the GED® testing phase of ABE enrollment, a 145 out of 200 is required on

GED® Ready before the correlating official GED® exam can be taken. In addition, the minimum score is required for all four subject areas. After meeting all test scoring requirements, the adult learner earns an Arkansas High School Equivalency Diploma.

Analysis into other factors that determine exit examination readiness needs to be explored. Many ABE programs are not considering the last grade level completed when deciding if a person is ready to exit the program. ABE programs in Arkansas must adhere to a minimum attendance of 40 hours before exit testing is allowed. DRC sets the minimum hours of enrollment at 40 to prevent a practice effect on the two versions of the TABE. Adults enrolling in ABE to earn a GED® are hitting a barrier to completion and are not earning a GED® diploma for distinct reasons. I have witnessed that adult learners leave ABE enrollment after an average of 25 hours, falling short of the minimum hours recommended by the test publisher.

Each adult learner has a diverse skill set and learner experiences. Some may have test-taking abilities. Some adult learners may be versed in memorization skills. Some may be avid readers. Some may not be able to comprehend what they read. Each adult learner is unique, and the amount of instructional time will vary amongst adult learners. Analyzing more than one factor to determine if a better way to identify post-test readiness is available to ABE programs, including attendance rate, consistency, total hours needed to demonstrate learning, quality of instruction, and the ability to understand instruction. Through analysis of multiple factors, a recognition of an adult learner's diverse skill set and experience may occur.

When an adult learner needs to earn their diploma rapidly, the minimum instructional hours create issues. Before the 40 instructional hour mark, Arkansas ABE programs are allowed to test early but must submit a waiver request for approval for an early test. Comparing entry

exam scores between successful completers that tested earlier than their peers, I noted a variance in the final grade level completed and entrance exam scores.

The notion of how many more adult learners within my program could be ready for the GED® test sooner remained questioned. I plan to explore more factors to ABE adult learner success other than instructional hours. Is the quality of instruction a factor in success in ABE? Is the frequency that the adult learner has engaged in instruction a factor in success in ABE? Is the ability to understand instruction a factor to success in ABE? Is the last grade level of compulsory education a factor in success in ABE?

Questions in the preceding paragraph can be assessed in a calculation in other areas of learning outside of ABE. For example, in the early 1960s, John Carroll proposed a degree of learning calculation for English Language Learners (Carroll, 1963). He concluded that the time a person needs to learn something is proportional to the ability to comprehend instruction (Carrol, 1963). Over time his research included the quality of instruction and the percentage of time a person was engaged in learning as factors affecting the degree of learning (Carroll, 1967). Carroll would coin his degree of learning calculation as *Carroll's Model of School Learning* (Carroll, 1963). This chapter discusses how Carroll's Model of School Learning factors should be considered when determining when an adult learner is ready to take the TABE post-test.

Due to DRC's 40-hour testing requirement, ABE programs in Arkansas provide a similar amount of instructional time to all adults. The ABE instructional programs providing services to adult learners have a rote testing process. The ABE programs must approach testing the same for each adult learner, regardless of age and past education level. Two programs I directed in northeast Arkansas have ABE students with various hours. The wide range of hours indicates that instructional time to completion rates vary among the ABE population. ABE programs do

not have a guiding principle to evaluate the readiness to retest other than clock hours. A possibility exists that adult learners may be exposed to the post-test too soon or too late; no one knows until the score comes back. Based on the research for this study, I propose that a scale of readiness be developed that can be used to cross-reference each of the factors of Carroll's model about the adult learner enrolling in the future. To determine when post-testing should occur, each construct of this study can be calculated and compared, including the final grade level completed, the persistence of attendance, ability to understand instruction, quality of teaching, and total instructional hours.

In the past, adult learners who tested earlier than their peers have exhibited success differently from adult learners with more hours who have failed to demonstrate learning progress. For example, during the 2019-2020 academic year, my program had approximately 675 adults enrolled. Of the 675 enrolled adults, 267 attended 12 hours or more; the remaining 408 attended for less than 11.75 hours. Of the 267 adults with 12 or greater hours, 51 graduated from the program. The hours varied for the 51 graduates; some of the 51 included adult learners tested before DRC's recommended timeframe. As a result, 624 people failed to earn their diplomas that school year. The 2019-2020 enrollment figures are not isolated; I have witnessed 2017-2018 and 2018-2019 program years with the same degree of failure to complete. Since people have been successful at varying rates of time, then a different method for post-test readiness needs to be identified, or more adult learners will join the lack of success statistic.

Currently, 40 hours is usually perceived as a measure of test readiness. Although this measure works well for some learners, it is a significant barrier for others. Some adult learners see this as a barrier because they were hired for a job under the premise of earning a diploma; others have time commitments elsewhere in their life, and they need their diplomas now. For

example, the average time in an Adult Education program in Arkansas is 25 hours, 15 hours fewer than required to take the GED®. As a result, most adult learners exit the ABE program before reaching the minimum testing hours.

Carroll's Model of School Learning suggests that critical predictors of learning success come from a learner's history (Carroll, 1967). Carroll's Model of School Learning metrics and constructs are last grade level completed, the persistence of attendance, ability to understand instruction, quality of teaching, and total instructional hours. All combined metrics and constructs of Carroll's Model of School Learning are not considered when determining post-test readiness. I chose this model for the study because the degree of learning is readily available for any ABE program in Arkansas to access and analyze. This study seeks to determine if those constructs are worthy of consideration.

This chapter will examine three elements of the current intake test and post-test constructs related to Carroll's Model of School Learning and instructional time. I then theoretically define concepts related to the ABE assessment and describe the questions guiding this study. I conclude this chapter with a discussion of the proposed study's scope and limitations.

Background of the Study

The average time rate for each person to qualify to take the GED® varies. From fiscal year (FY) 2017 to FY21, the program earned GED® and instructional time to completion for the following totals and range:

- 254 GED®
- Average time to completion, 85 hours
- Adult learners earning a GED® in less than 40 hours, 96 (38%)

The variety of completion times and the percentage of completers before the 40-hour mark led to a search for a better way to determine exit test readiness (post-test). An additional disparity lies when a person with a reading ability less than a person's final grade level completed may qualify to take the GED® before someone who reads on their final grade level completed. In the last completed program year (2019-2020), the program that I direct reported:

- 675 adult learners enrolled
- 276 enrolled for 12 hours or more (41%)
- 157 enrolled for 40 hours or more (23%)
- 51 earned their GED® (8%)

It seems that readiness to test should consider more factors than classroom instructional time alone. To ignore factors other than time is to decide post-test readiness without considering the impact of other factors on learning.

The minimum attendance requirement is a problem that affects many adult learners in the ABE program. Many adult learners are impacted. For example, 59% of the annual ABE program enrollment did not make it to 12 hours of attendance. I found that 77% did not attend for 40 hours or more. As a result, ABE programs cannot demonstrate that learning has occurred without a post-test because of the minimum attendance requirement. Since the post-test cannot be given until after 40 hours of class time, up to 35% - 43% of the program's instructional efforts are unacknowledged, and resources may be unfunded.

I believe that constructs of Carroll's Model of School Learning (a) persistence or frequency of attendance, (b) instructional hours needed, (c) instructional hours attained, (d) ability to understand instruction, and (e) quality of instruction, can better determine if an ABE adult learner is ready to post-test. Attendance time and persistence of attendance are of interest.

Frederick and Walberg's often-cited research (1980) from their *Learning as a Function of Time* publication, a meta-analysis of 54 national surveys of 80,000 responses, suggested that more years of education equaled high reading levels. Frederick and Walberg (1980) stated that "when time spent in a learning situation is measured over relatively long spans, the results show a modest but persistent association between the outcome measure and time" (Frederick & Walberg, 1980, p. 187). Before Frederick and Walberg (1980), Carroll believed that a learner's frequency in learning determines the amount of learning. For example, as it relates to the previous example, the frequency would relate to the number of sessions attended. Thus, it is possible to compare an ABE learner who attends four of the eight sessions (50% frequency) in outcome score to an ABE learner who attends at a greater or lesser frequency. As it relates to learning, Carroll reasoned that time is the amount of time a person dedicates to learning a task. For example, an ABE location offers eight class sessions each week at two hours per session, and learners attend all sessions plus study on their own at home for two hours a week.

According to a meta-analysis of correctional programs, Carroll also rationalized that the quality of instruction impacts learning (Reed, 2015). Therefore, while Arkansas ABE programs are not held to attrition standards, they are held to quality instruction ratings. The *Effective and Efficient* (E & E) rating, calculated by dividing the number of increases in education functioning levels by the number of participants in the program, is the U.S. Department of Education measures benchmark attainment for each state. Therefore, the E & E for each ABE program throughout the state are averaged to determine a state rating.

I believe that the commitment to continue enrollment could have caused participants to stop attending. Reed's (2015) meta-analysis of six ABE correctional program studies linked attrition to curriculum delivery differences. Reed (2015) revealed that attrition was affected by

the instructional delivery method; computer-delivered instruction resulted in worsening attrition compared to teacher-delivered instruction, which resulted in decreased persistence and difficulty making progress. ABE's instruction quality is a rating associated with an individual learner's learning metric derived from State provided ratings and included in Carroll's Model of School Learning.

Carroll also included the ability to comprehend instruction as a learning factor. A study of high school-aged Algebra students found an interaction at the .05 level between the ability to comprehend instruction and quality of instruction (Hymel, 1974). The ABE participant may be leaving the program because of a stressful learning process due to instruction provided above or below their understanding level. Fredrick and Walberg's meta-analysis (1980) noted simple correlations between understanding reading and attendance at .72 and.66 in a follow-up study after controlling for poverty. The ability to understand instruction refers to "that characteristic, general intelligence or verbal intelligence, which determines the extent to which the individual will be able to understand directions and explanations from the total content of the instruction even when they are lacking" (Carroll, 1962, p. 122). The ability to comprehend instruction as a learning factor makes up an analyzable component of Carroll's Model of School Learning. This study seeks to analyze the correlation between it and the other constructs of the model.

An obstacle that further holds ABE programs is the time required before an ABE adult learner counts in the performance measurements. The ABE adult learner is not officially enrolled until they have completed 12 hours of classroom attendance. To this point, 59% of those enrolled in 2019-2020 did not reach the minimum requirement of 12 instructional hours. Year in and year out within my program, most adult enrollment is not counting for the program for measured outcomes due to a lack of minimum attendance requirements. The Office of Career and

Technical Adult Education (OCTAE) funding standards set 12 hours as the enrollment mark. Likewise, DRC, publisher of TABE 11 & 12, sets the 40-hour post-assessment requirement for the TABE. The pairing of the 12 hours and the 40-hour rules impacts the overall participation level for the program.

The ABE program is assessed by the success rates of those participants with 12 hours of instructional time. Counter to the 12-hour rule, not all enrollments reach the 40 hours requirement; hence, the program cannot demonstrate that each person's reading level increased because they could not administer a post-test. The combination of Federal policy (12 hours) and testing guidelines (40 hours) does not align with research findings related to Carroll's model's variables.

Carroll's Model of School Learning

Carroll (1962) hypothesized that the time needed to learn related to academic achievement was impacted by a person's intelligence, quality of instruction, time available to learn, and time spent learning—the constructs of the degree of learning formula (Carroll, 1963, 1989). Carroll (1963) studied learning tasks to develop a two-part model for learning. The model divides learning into a series of sub-tasks. According to Carroll (1963), instructional variables and individual difference variables are the factors that impact learning. Instructional constructs are factors outside the learner, such as quality of instruction, teacher preparation, and instructional resource development. Individual difference constructs are the ability to understand instruction, aptitude, the opportunity to learn (OTL), and perseverance. To determine relevant predictive factors to test readiness, I will draw on Carroll's Model of Learning (1962). Carroll's (1962) first interrelated five variables believed to be essential to learning are aptitude, ability to understand instruction, perseverance, OTL, and quality of instruction. Carroll's Model

constructs can be calculated to a final integer due to each variable fitting within a fraction. Carroll's Model of School Learning (1963) previously determined that learning is a function relative to time. Figure one below (Cogan et al., 2019) displays each construct of Carroll's Model. This study will apply quantifiable data in the functional equation below for each variable.

$$\text{degree of learning} = f\left[\frac{\left(\begin{array}{c}\text{OTL or}\\ \text{Time allocated for learning}\end{array}\right) \times \left(\begin{array}{c}\text{Perserverance or percentage of}\\ \text{time actually spent engaged in}\\ \text{learning}\end{array}\right)}{\left(\begin{array}{c}\text{Aptitude or}\\ \text{Time actually needed to learn}\end{array}\right) \times \left(\begin{array}{c}\text{Quality of}\\ \text{instruction}\end{array} \times \begin{array}{c}\text{Ability to understand}\\ \text{instruction}\end{array}\right)}\right]$$

Figure 1. Carroll's Model of School Learning (Cogan et al., 2015).

The OTL concerns the time allowed for learning. Carroll (1962) defined perseverance as "the maximum amount of time an individual would apply themselves to the learning of a task" (p. 122). Likewise, Carroll (1962) defined aptitude as the time an individual needs to learn a task to a specified learning criterion (Carroll, 1962). Individuals' TABE Locator scores will reflect the ability to understand instruction. Within the function, the ability to understand instruction is multiplied by the quality of instruction and the time needed to learn. The quality of instruction is defined as "a measure of how the task is presented and explained, and how appropriately it is placed in the sequence of graded tasks to be learned" (Carroll, 1962, p. 122). Quality of instruction, for this study, will be measured as E & E numerical value for the ABE program, a nationally recognized rating used to measure program success.

Each of the constructs in Carroll's model can be calculated as a numerical value from data available to any ABE program in Arkansas. ABE programs can readily find a solution for each person's degree of learning. This study will analyze the degree of learning for adult learners enrolled from 2019 to 2020 within the State of Arkansas' Adult Education programs to determine relevant predictive constructs for test readiness. That same degree of learning is

assumed to be a linear function of this ratio. Carroll's Model should appear as the *degree of learning = OTL x perseverance/aptitude x (quality of instruction x ability to understand instruction).* Using Carroll's Model, I will calculate a numerical value for each adult learner in an ABE study sample by formulating the five constructs of Carroll's Model of School Learning for each ABE participant within the study's data field.

The aptitude or time needed to learn varies for each adult learner, depending on a learner's previous educational experiences. Some adult learners went to schools that exposed them to high-quality instruction, while others may not have experienced quality instruction. Since past educational experience is unique for each adult learner, a standardized calculation will measure it. That standard measurement, Carnegie Unit, will standardize the calculation for each person in the sample. Public schools use the Carnegie Units (120 hours per grade level) to measure grade-level completion time. Each grade level finished is multiplied by 120 hours to determine the time needed to learn. Perseverance is calculated based on the percentage of time spent learning in 90 instructional days. Each instructional session will serve as the denominator for the perseverance calculation, while the number of sessions attended from the total will be the numerator. Once the perseverance fraction is determined, then the denominator to calculate the perseverance percentage will divide the numerator. Lastly, the OTL will be the total time accumulated by the adult learner.

TABE 11 & 12 Scoring

The post-test score results of TABE 11 & 12 determine if the adult learner can take the GED® Ready Test (Arkansas guidelines require a 535 or greater out of 800). If adults do not score the minimum cut score on TABE that allows them to take the GED® Ready test (535 out of 800), they must receive another 40 instructional hours before taking the other TABE 11 & 12.

A different testing series takes place if a 535 or higher is achieved. For adults with more than 60 hours of instruction, an alternate version of the TABE does not have to be administered (pre-test TABE 11 & post-test TABE 11). If the total enrollment time is less than 60 hours of instruction, DRC requires alternating testing with TABE 11, then TABE 12, or TABE 12, and then TABE 11.

Arkansas Division of Workforce Services (ADWS), Adult Education Section (AES), requires adult education programs to file a waiver for early testing. The early testing waiver provides insight into how an adult does not have the minimum score without violating an early testing policy threshold. In addition, this allowance casts a glimpse of how the minimum instruction hours may impact the TABE 11 & 12 score. On the one hand, I have seen adult learners in all U.S. Department of Education (USDE), Office of Career and Technical Adult Education (OCTAE), and National Reporting System (NRS) levels earn 535 or higher out of 800 to become GED® Ready eligible from a wide range of instructional hours more than the required amount. On the other, I have seen some progress to completion in 20 hours or less. Also, I have seen progress take years, with the total classroom instructional hours ranging as high as 500 - 855 hours.

A gap in the literature exists for adult education studies that use TABE 11 & 12 data. The combined constructs that make up the degree of learning derived from Carroll's Model of School Learning are also absent from ABE studies. No studies apply Carroll's Model of School Learning to ABE since most researchers have applied his model to primary education levels. A further literature review does not reveal any studies on the variance in TABE 11 and 12 scores from Carroll's Model of School Learning metric.

Most of the ABE studies that analyzed pre- to post-test measurements were conducted with older TABE versions. Only the TABE 11 & 12 are computer-based-all other versions were paper and pencil tests--and TABE 11 and 12 were developed by a different company (McGraw-Hill Education for previous versions). This study is necessary because ABE programs need to learn what other constructs affect TABE 11 & 12 post-test scores.

TABE Scores Resulting in Ability to Understand Instruction

The DRC documented each study participant's level of ability to understand in the published validation study. Despite incoming assessed levels at NRS 1 and NRS 2, the final placement charting resulted in a six-level system aligned with federal policy requirements. The numerical range of the six-level DRC scoring system was derived from the publication study participant data (**Table 1**). It is important to note before going in-depth with the entering levels that:

- NRS Level 1 is a reading ability similar identified as kindergarten to the first-grade ninth month
- NRS Level 2 is the second grade to the third-grade ninth month in reading ability
- NRS level 3 is the fourth grade to the fifth-grade ninth month
- NRS level 4 is the sixth grade to the seventh-grade ninth month

Table 1: *Percent of DRC Examinees Classified in Each NRS EFL, by TABE Level, based on the Final TABE Cut Scores (DRC, 2017)*

	Content	NRS Level 1	NRS Level 2	NRS Level 3	NRS Level 4	NRS Level 5	NRS Level 6
Reading	Literacy	68%	32%				
	Easy	25%	50%	25%			
	Medium		53%	24%	23%		
	Difficult			66%	22%	13%	
	Advanced				77%	15%	8%

The DRC noted that the levels of rigor needed for test delivery (L for language, E for easy, M for medium, D for difficult, and A for advanced) varied across the levels identified in the validation

study for TABE 11 & 12. Even though the study participants identified various reading ability levels, the test publisher assigned the same standard of post-test time of 40 hours (***Table 2***).

Table 2*: Final, Implemented Cut Scores for TABE (DRC, 2017)*

Content	Final TABE Cut Scores				
	NRS Level 2	NRS Level 3	NRS Level 4	NRS Level 5	NRS Level 6
Reading	442	501	536	576	617

This problem appears severe and relevant because I direct a three-county Adult Education program in northeast Arkansas. The attrition rate remains consistent between my previous one-county Adult Education program and my current three-county program. Adults who are not successful in achieving the required minimum score on TABE 11 & 12 choose not to re-attempt the 40-hour cycle in ABE. The attrition rate is 77% from the 2019-20 ABE enrollment, and 92% were not eligible to attempt the GED® test.

Statement of the Problem

The problem for all ABE programs is that learner attrition before 40 hours of attendance prevents the Adult Education program from reporting measurable skill gains. In addition, early separation from program services before 12 hours of enrollment consumes resources, time, and grant funds. For example, the USDE regulates enrollment guidelines, specifically the OCTAE. One of the OCTAE guidelines is related to time. Once an adult is enrolled in an ABE program beyond 12 hours, the program will receive funding credit for instructing the person towards increasing their reading level, earning a diploma, attaining a job, or earning more (all measurable skill gains). A sizable portion of the annual enrollment of two ABE programs that I directed comprises adults with fewer than 12 hours of instruction; therefore, until those adults reach 12 hours, all instructional costs, efforts, support staff time, and consumed supplies remain

uncompensated. Once the 12-hour threshold is reached, the ABE program is measured, assessed, and required to meet outcome performance standards (NRS Technical Guide, 2019). The performance-measured outcomes include the following:

- achieving a secondary diploma or equivalent,
- secondary or post-secondary transcript,
- education functional level gain (assessed by pre-test and post-test, completion of Carnegie Units, or program exit and entry into post-secondary education),
- progress toward milestones, and
- passing technical/occupational knowledge-based exam(s)

Significance and Purpose

This study aims to see if there are better predictive factors of test readiness than the ones currently used. An ABE barrier in Arkansas is that instructional time is the only variable currently used to determine readiness for advancing beyond the TABE 11 & 12 test to high school equivalency testing. The significance lies in potentially allowing individuals to advance to TABE post-testing and, therefore, other GED® completion, thereby lowering the program's attrition rate and increasing its success rates.

This study will analyze the relationship between the independent variable, degree of learning (as measured by Carroll's model), and the dependent variable, TABE 11 & 12 post-test scores. This study addresses a gap in the literature on TABE 11 & 12. The information gathered in this study will be particularly useful to stakeholders within Adult Education, which is reliant upon advancing ABE participants' progress toward GED® testing eligibility. Specifically, Adult Education instructors rely upon the pre-test TABE 11 & 12 scores to estimate the length of time required for completion. However, these estimates are not supported by practice within the

bounds (62% historical GED® attainment post-40 hours of instruction) or out of policy boundaries (38% historical GED® attainment in under 40 hours of instruction). Adult Education administrators could benefit from having accurate research-based performance metrics to predict enrollment completion times. Further, it remains mostly unknown how the independent variables, the degree of learning, affect a learner's ability to progress in the TABE 11 & 12 assessments.

Noteworthy results may lead to a change of practice in programs throughout Arkansas. This study's results may also affect adult education policy, such as the 90 days of participation. This study may find that specific ABE enrollment may require greater than 90 days to advance to the next reading level. Inversely, the study results may find that reducing the 90 days of participation is necessary for enrolling TABE scores. This study's fundamental motive is that each ABE enrollee has unique experiences before enrolling; therefore, treating each without regard for those experiences does not align with previous research findings. This study's findings will provide ABE programs with several factors, other than pre-test TABE 11 & 12 scores and instructional time, that they may use to predict post-test TABE 11 & 12 scores.

Research Question

This study's central research question is: Does Carroll's Model of School Learning account for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age? The hierarchical linear regression analysis results will allow me to explain the amount of variance in TABE 11 & 12 post-test scores for each level of adult learner (ABE 1, 2, 3, and 4) concerning Carroll's degree of learning metric.

Definitions

Test for Adult Basic Education 11 & 12 (TABE 11 & 12): the sixth-generation test was designed and developed to provide achievement scores valid for most adult education decision-making (DRC, 2018).

- TABE Level 1: Scale score of 300-441 (Grade Range Guideline of K-1)
- TABE Level 2: Scale score of 442-500 (Grade Range Guideline of 2-3)
- TABE Level 3: Scale score of 501-535 (Grade Range Guideline of 4-5)
- TABE Level 4: Scale score of 536-575 (Grade Range Guideline of 5-6)

National Reporting System (NRS): The NRS is the accountability system for the federally funded, state-administered adult education program (NRS, 2019).

General Educational Development (GED®) *Test*: The American Council on Education sets four comprehensive tests in reasoning through language arts, mathematical reasoning, science, and social studies, creating its passing requirements in cooperation with each state (U.S. Department of Education, Office of Career, Technical, and Adult Education, 2017). Completing all four portions is required to earn a general educational development.

Educational Functioning Level (EFL): Twelve individual levels identified by the NRS compose a hierarchy of categories, addressing a comprehensive set of standards and competencies that adults must demonstrate to move to the next level. Each level addresses competency areas, including basic reading and writing skills, numeracy skills, functional skills, and workplace skills (Virginia Department of Education, Office of Career, Technical, and Adult Education).

Adult Basic Education (ABE): Instructional programs that provide basic skills for adults who are performing below the ninth-grade level in reading, writing, mathematics, and other

essential skills; ABE may include pre-GED® preparatory components (Virginia Department of Education, Office of Career, Technical, and Adult Education, 2017).

Participating Adult Learners: Adult learners aged 18 and up who attend an Adult Education program for more than 12 instructional hours.

Literacy, Adult and Community Education System (LACES): the online database for tracking outcome measures such as educational gains, goal achievement, demographic information, and attendance hours for ABE/Adult Secondary Education (ASE)/English as a Second Language (ESL) programs. The database collects and reports all NRS-related data and generates all required and optional NRS tables (Literacy Pro, n.d.).

Enrolled Adult Learners: In Arkansas, adult learners entered the National Reporting System (NRS) database, LACES, between 0.25 hours of instruction to 11.75 hours of instruction.

Scope and Limitations

This study's sample size will include a stratified random sample population from all 37 ABE programs in Arkansas. The data set used for the sample studied conforms to the Workforce Innovation and Opportunity Act (WIOA) standards and the NRS, and the ADWS-AES. The data set will be provided by government agency representatives.

Multiple attempts at the TABE limit the validity of the independent variable's effects on the dependent variable; for example, a person who pre-tests in the TABE will post-test in the TABE after 30-40 hours of instruction. If the person does not earn a scale score of 535, they must return to class for another 40 hours (complete instruction cannot be greater than 160 hours without a single pre-test and post-test cycle).

There exists a limitation within the TABE 11 & 12 assessment that is not controllable. TABE 11 & 12 do not have equal intervals between levels. Venezky, Bristow, and Sabatini

(1994) warned that a lack of equal intervals in a scale range might create a problem in a small sample size. In that condition, they cautioned that the change in pre to post-test scoring might be deceiving. They referred to an older version of TABE when cautioning about a one-point correct answer change (31 correct to 32 correct, which is a 757 to a 760) that demonstrates four months of grade-level equivalency learning (0.4). The older TABE scale results in a 1.6-grade level change for the same 3-point difference (771 to 774). The study's scale variance limits due to the newest TABE test results not being on a grade-level equivalency and solely on a scale score. Therefore, other researchers may be prone to miss the study's intention as not being a study of grade-level equivalency; instead, this is a study of the scale score change related to age, education level, instructional hours, and pre-test TABE 11 & 12 scores.

Another limitation of the study arises from the two-wave testing design at two points in time (Venezky et al., 1994). The appearance of linear growth emerges from a pre-test to post-test design, but it may be possible that some other growth curve exists besides a linear one. Venezky et al. (1994) cautioned that the diverse entering scores of adults entering ABE programs are not considered in the whole-program data collected and reported as one report; thus, the limitation of the study is that personal effects are challenging to account for in a study of this nature. Finally, the other statistical limitation is a regression to the mean from the sizable percentage of attrition in ABE programs, therefore, biasing pre-test to post-test differences (Venezky et al., 1994).

Summary

In this study, I seek to apply Carroll's Model of School Learning to an ABE population and determine if it is a better predictor of test readiness than instructional time. A high percentage of people entering the ABE program do not graduate each year. Therefore, the expectation is that another model exists to determine testing readiness instead of the current

practice that would help ensure a higher rate of graduating students. Using Carroll's Model, I will analyze a learning metric for past ABE participants to determine if the metric predicts their success.

Adult education programs across the nation would benefit from learning the applicability of Carroll's Model to their adult learner populations. The constructs of the model are readily available for calculations. These constructs consider more individual circumstances of adult learners instead of the factor of time alone. In this chapter, I reviewed the background of the study. Then, using John Carroll's model, I will conduct the study to determine the degree of learning for ABE participants.

Chapter Two: Review of the Literature

This chapter's literature review should provide information about ABE, TABE, and Carroll's Model of School Learning assessment. In addition, this chapter includes the study's hypotheses and conclusion. The chapter opens with the background of ABE. Next, it covers the historical barriers to the completion of ABE. Finally, the chapter will conclude with an in-depth overview of the reading assessment (TABE), literacy models, and Carroll's Model of School Learning.

Background of Assessing Outcomes in ABE

In 1998, federal legislation (Title II, Section 112a) implemented the state's requirement to record learning outcomes to use federal funds for ABE programs. Since 1998 the TABE has met the federal requirements for assessing outcomes in ABE. The TABE has changed over time, as noted by each version number; the 11 & 12 version still meets the Title II, Section 112a requirement. The TABE 11 and 12 serve that purpose; therefore, it is the assessment tool used in adults' formalized teaching (U.S. Department of Education, Office of Career, Technical, and Adult Education, Division of Adult Education and Literacy, 2017).

Instructional Time and Learning

A solid body of literature investigating the effect instructional time has on learning promotes that time in an instructional setting is a component measured and reported in ABE, most often referred to as instructional hours. Several studies have highlighted diverse factors associated with instructional hours and learning (Bennett, 1978; Bloom, 1976; Bruner, 1966; Carroll, 1963; Cooley & Leinhart, 1975; Gagne, 1977; Glaser, 1976; Harnischfeger & Wiley, 1976). The research results have identified constructs other than instructional hours that affect TABE scoring. The past studies' results provide the foundation for exploring whether the current

practice of determining post-test readiness is the best. Instructional hours in Adult Education are a determining factor for post-testing with TABE 11 & 12. Adults enrolling in ABE in Arkansas must be assessed using TABE 11 & 12 within the first 12 hours of instruction in either reading, mathematics, or language. The adult learners must attend a minimum of 40 hours of instruction before taking the post-test TABE 11 & 12. Based on the TABE 11 & 12 post-test score, a program can determine subsequent testing options for the adult learner. Scores under 535 out of 800 must return to class for at least 40 hours of instruction. Those scoring over 535 out of 800 can take the GED® Ready tests. Learners must score at least 145 out of 200 on reading - language arts, math, science, and social studies GED® Ready before taking the official GED® test.

Historical Barriers to Completion of ABE

In an Adult Education program in northeast Arkansas, adults who are not allowed to post-test do not achieve a 535 out of 800, the score they need for one or more testing cycles. As a result, some adult learners are exposed to the test too soon. Mikulecky (1986), in a paper presented at the National Reading Conference, reminded researchers that adults that read at a low level (ABE) are not comparable to children reading at low levels; therefore, the author concluded that the instructional approach should be different. Contrary to Mikulecky's (1986) position, Liebert (1983) argued that children were compared to similar ability ABE readers, and it was found that adults showed no variance inaccuracy when reading a difficult passage aloud as compared to children (Liebert, 1983). In terms of their reading ability, children and adults were the same in Liebert's study: as the text's difficulty increased, reading speed (words per minute) decreased (Liebert, 1983). Sticht (1982) analyzed the effect of the rate of presenting learning materials and the method for adult learners reading at the 5th-grade, fifth-month level (NRS

Level 3) and compared those results to third and 5th-grade children and found that adults did not perform better or learn faster than the children.

Other researchers have found links between reading rate and comprehension difficulties (Bristow, 1987). Past research has revealed that other factors lead to an inability to read well. Language comprehension and word recognition are two flat areas that impact reading ability (Scarborough, 2001). In a case study of adult readers, Johnston (1985) demonstrated that incorrect reading concepts, anxiety, unfounded corrective strategies, and motivation were barriers to improving reading ability. Skilled reading requires the adult learner to braid word recognition and language comprehension to mastery. Scarborough (2001) outlines several factors within language comprehension, and word recognition is referred to as *Scarborough's Rope*. The reading structure threads of language comprehension are background knowledge, vocabulary, language structures, verbal reasoning, and literacy knowledge (Scarborough, 2001). Braided into language comprehension is word recognition composed of the thread's phonological awareness, decoding, and sight recognition (Scarborough, 2001). The automaticity of these reading skills is dependent on childhood acquisition and exposure throughout a person's life. The time of exposure to hearing someone read aloud and the time spent reading before enrolling effects, to a greater degree, the reading ability more than hours of ABE attendance after enrollment. ABE programs can consider the final grade level completed in conjunction with the intake reading TABE 11 or 12 scores through Carroll's Model of School Learning. The low-level adult reader requires the same amount of time that a child of a similar ability requires to improve (Strict, 1983 & Scarborough, 2001). Further, the low-level adult reader will require as much time to prepare for the GED® exam as a child of the same level would require (Strict, 1983 & Scarborough, 2001). Identifying the adult learner's cognitive ability based upon intake locator score is a

current practice that is a component of Carroll's Model of School Learning; therefore, that variable is analyzed in this study.

Sometimes in ABE programs, some adult learners are kept beyond the 40 hours of instruction and remain in the program for too long without ever accessing the post-test. No one knows if those adult learners could have obtained the qualifying score needed to take the GED® test because they did not take the TABE 11 & 12 post-test. This study attempts to call attention to other variables and time to determine if a better learning metric exists, a metric that can be calculated to identify the optimal time to post-test for each learner.

Adult Learner Separation from ABE

Varying testing rates time may be why many leave the program without post-testing in TABE 11 & 12, at 59 - 77% each year. As a result, programs risk losing funding and having reduced GED® attainment, both of which are qualifications to maintain operations per OCTAE regulations. The current post-test practice impact is evident in the Arkansas State University - Newport Adult Education program. In the 2019-2020 program year, only 41% of those enrolled accrued 12 hours of enrollment (276 of 675), and even fewer enrolled—23% attended for 40 hours or greater (157 of 675).

Adult learner persistence to completion is likely impacted by reasons other than testing too early or too late. In a study of 245 female adult education participants from Tennessee, Ziegler, Bain, Bell, McCallum, and Brian (2006) attempted to isolate factors that lead to the completion of an adult education program. Ziegler et al. (2006) developed an Adult Education Persistence Scale (AEPS) that connected past school experience, school-related self-belief, resilience, and academic-confidence beliefs. Ziegler et al. (2006) derived that the two-part assessment correctly predicted 69% of the 245 study participants' eventual success when age was

included with the AEPS score from a discriminant function analysis. Upon further investigation, Ziegler et al. (2006) suggested that increased attendance is associated with decreased blaming of failure on the adult education program or luck. The findings from Ziegler et al. (2006) support positive-self intervention practice in adult education to help retain adult learners and teach adults that positive self-talk improves their success. The other factors that Ziegler et al. (2006) recommend for adult education schools to incorporate in response to high attrition rates include focusing on employment, family, and community, making learning tasks relevant, and embedding successful milestones while modeling validation attitudes. The numerous factors that Ziegler et al. (2006) debated in their study further reveal that the adult learner's completion of an adult education program is influenced by more than the frequency of testing.

When adults enroll in ABE, a placement TABE 11 & 12 test is administered within the first 12 hours of attendance, from which a scale score is derived. Despite the past education level (grade at dropout), the intake TABE 11 & 12 pre-test score is the basis of the instructional plan developed by ABE instructors. The first TABE 11 & 12 pre-test score measures the adult's cognitive ability, aptitude to learn, or learning ability (**Appendix B-G**). My interest in the topic arises from working with hundreds of adult learners who have been through my programs. Over time, I have seen adults progress at different speeds—needing various instructional hours based on different past education levels. Currently, the program can test a limited number of adults before 40 instructional hours (8% of the total number of enrollments with 12 hours or greater). The results have been intriguing. Adult learners at various levels are increasing scores from pre-test to post-test TABE 11 & 12 before the recommended testing time. These factors have contributed to my interest in exploring how time impacts learning.

The strategy I used to find resources for this chapter entailed a two-part search using Google Scholar and the University of Arkansas-Fayetteville Distance Learning Library Quick Search. The keywords learning AND time AND adult AND TABE were used to collect peer-reviewed and scholarly resources. Databases utilized in researching the literature included ProQuest Central, ERIC, and APA PsycINFO. All resources utilized were in full-text format.

Background of the TABE, 11 & 12

The DRC mandates a 40-hour minimum of instructional hours. The DRC promotes a 40-hour minimum before post-testing to reduce the practice effect. There is no justification for 40 hours of instruction, nor does the general rule consider other factors included in Carroll's Model of School Learning, such as the incoming learners' literacy level, their last grade completed, or their age.

TABE Findings

Researchers have studied instructional hours (time) on learning (Carroll, Carver, 1970; 1963; Cook, Levinson, & Garside, 2010; Gettinger, 1984; Milma, Bieger, Klag, & Pine, 1983; Sjorgen, 1967). In addition, scholars have focused on previous versions of the TABE (Piccone, 2006). The TABE has changed formats, the rigor of difficulty, and ownership from version 1 to versions 11 and 12. The TABE was a paper exam from versions 1 through 10, validated and organized by McGraw-questions' structure.

A TABE 11 & 12 test taker is now assessed through a computer or tablet instead of paper and pencil. The structure of the questions is selected-response (SR), evidenced-based selected-response (EBSR), multiple-select (MS), and technology-enhanced (TE) (DRC, 2017). However, there is a gap in the research on TABE 11 & 12. Previous research on the effect of time on learning has revealed more factors affecting learning than time alone.

Conceptualizations of the Reading Assessment in TABE 11 & 12

This section reviews the evidence that empirically determines the areas that encompass adult learners' reading ability related to the TABE 11 & 12 assessment. The TABE 11 & 12 reading assessment "measures the ability to recall and recognize information, make inferences and evaluate forms that are familiar in adult life, published fiction and nonfiction passages, and reference and consumer materials" (Mellard, Woods, Md-Desa, & Vuyk, 2015, p. 313). TABE 11 & 12 is only one of many assessments allowed by WIOA guidelines that states utilize to prepare adults for the GED® test. Most of the United States' Adult Education programs—in 42 out of 50 states—use the TABE. In the sixth version of the assessment, learners use a computer or paper and pencil (DRC, 2017). The DRC is statistically sound and was validated through norm sampling. DRC promotes the construct validity of the test items and test scores (DRC, 2017). A series of intercorrelation statistical analyses between other adult education assessments were conducted in 2016 before TABE 11 & 12 was made available (DRC, 2017). According to DRC's Technical Guide, the assessment was field-tested with approximately 3,000 adults in 38 states in 501 institutions (DRC, 2017).

Adult education programs use reading performance scores from the TABE 11 & 12 Reading assessment to identify entry-level literacy proficiency. For the test, reading is divided by DRC into assessable subdomains. The degree of accuracy from 18 tested items determines the proficiency of that reading skill. The results inform the ABE instructor about the learner's level of proficiency in reading foundational skills. The degree of reading foundational skills affects the assessed reading ability of an ABE adult learner. It also relates that the earlier adults learned to read as children determine their later success. The longer it took them to acquire reading skills as a child, the longer it took them to become proficient readers (Stanovich, 1986).

Instructors of Adult Education analyze TABE 11 & 12 Reading assessment profile reports to identify learners' non-proficiency, partial proficiency, and proficiency in assessed areas of (1) craft and structure, (2) integration of knowledge and ideas, and (3) phonics and word recognition (DRC, 2019). Investigating low literacy skills is a continuing concern for Adult Education practitioners (Tighe & Schatschneider, 2016). The reading assessment profile provides a glimpse into the sub-domains of reading an adult learner may be deficient in, thus giving ABE instructors the reading capabilities of ABE adult learners.

Of particular concern are the tenets of functioning literacy. The tenets that provide the highest significance to an adult learner are (a) phonological awareness, (b) short-term memory, and (c) orthographic knowledge (Thompkins & Binder, 2003). These concerning tenets are derived from a study of 60 adults that have been identified at the fifth-grade mean reading level (Thompkins & Binder, 2003). Thompkins and Binder (2003) concluded that ABE participants have phonological awareness and decoding ability but are better at orthographic knowledge (spelling, hyphenation, capitalization, word breaks, emphasis, and punctuation) (**Table 3**).

Table 3*: The Subscale of the Percentage Components of the Dependent Variable, TABE 11 & 12 Reading (DRC, 2017)*

	Level L	Level E	Level M	Level D	Level A
Phonological Awareness	23%				
Phonics and Word Recognition	23%	16%			
Key Ideas and Details	28%	37%	47%	47%	47%
Craft and Structure	16%	32%	42%	38%	42%
Integration of Knowledge and Ideas	10%	15%	11%	15%	11%

Using the existing body of research on adult literacy skills, Tighe and Schatschneider (2016) categorized literacy into three different skills: (1) morphological awareness (knowing prefixes,

suffixes, and root words), (2) pseudoword morphological awareness (knowledge of non-words), and (3) vocabulary knowledge. These primary abilities have been identified to improve adult learners' literacy skills (Tighe & Schatschneider, 2016). An ABE instructor can determine adequate teaching sequences when combined with the TABE 11 & 12 Reading proficiency rating (determiner for the level of rigor on the TABE 11 & 12) and the participants' age, previous educational experience rigor, and materials.

Reading Scale Score from TABE

The reading scale score of the TABE assessment refers to a standardized assessment used to determine a student's initial (pre-test) reading comprehension and its repeated use (post-test) to monitor progress over time (Tighe, Barnes, Connor, & Steadman, 2013). TABE test scores range from 300 to 800. The TABE scores align with descriptions of basic reading, writing, numeracy, and functional and workplace skills. Therefore, the scores should be expected from a person functioning at that level. The levels of TABE are ABE (NRS Level 1-4) or adult secondary education (NRS Level 5-6) (U.S. Department of Education, Office of Career, Technical, and Adult Education, Division of Adult Education and Literacy, 2017).

Models of Learning for Literacy

Time and learning studies can be grouped into enrichment and acceleration (Frederick & Walberg, 1980). The difference between each is the fixed component. The fixed component for enrichment studies in time and learning is time, and the varying component is an achievement (Meehan & McCallig, 2019). The fixed component is an achievement; the varying component is time (Meehan & McCallig, 2019). In both categories, learning is perceived based on ability and time. However, meta-analysis researchers Frederick and Walberg (1980) and Gettinger (1984) distinguish time and learning from enrichment and acceleration.

In contrast, Carroll's work is based on the premise that time spent learning is fixed (enrichment), but the learning results are varied. Bloom (1971, 1984) disagreed with Carroll's beliefs about enrichment learning. As Bloom (1971, 1984) believed that mastery learning (acceleration) was a fixed level of achievement while the time spent learning varies (Frederick & Walberg, 1980; Gettinger, 1984). After Carroll, Bloom researched more follow-up studies, thus casting a shadow over Carroll's work resulting in less-publicized studies than Bloom. Since Carroll's work (1963) was conducted on English Language Learners (ELL), and his enrichment model fits the current practice of adult education (time as a fixed variable), his research guides this study. This study will analyze the enrichment approach to ABE, which posits that time spent learning is fixed, and the learning results are varied.

Assessing Reading in ABE

Meta-analysis researchers have identified two types of time and learning studies (Frederick & Walberg, 1980; Gettinger, 1984). Starting with Carroll's work (1963), then Bloom's work (1971), Frederick & Walberg (1980), and Gettinger (1984) identified differences between the fixed component or varying component; time (enrichment) or achievement (acceleration) (Meehan & McCallig, 2019). Frederick and Walberg (1980) represented Carroll's Model of School Learning in a regression, "learning = a + b (ability) + c (time) + error." When the two theories are compared, ABE uses an enrichment approach that Carroll (1963) depicted as the model; the gateway processes for progressing in ABE are designed to be fixed on time and vary on achievement. Using time to determine progress in ABE is the basis for enrichment models of time and learning; therefore, enrichment will be the model for this study. According to Bloom (1971, 1984), acceleration is the framework for learning mastered tasks. Frederick and Walberg (1980) and Gettinger (1984) identified enrichment as the framework for comparing

achievement tests for proficiency in learning. The historical foundation of this study is the enrichment framework. Since ABE programs test for a proficiency score (535 of 800) before progressing to adult learners, an enrichment model of time and learning study is acceptable.

Reading Assessment in ABE and Carroll's Model of School Learning

Through his research, Walberg (1978) challenged Bloom's previous acceleration theories and Harnishfeger and Wiley. Walberg (1978) reported that time might compensate for low-quality instruction, similarly to how learner aptitude may compensate for instructional hours. Walberg (1978) ratiocinated that more attendance in a class with poor instruction is required for the learner to gain a similar learning level compared to a high-quality instruction that takes less engagement to learn more. Walberg's research includes three components to Carroll's Model of School Learning (quality of instruction, ability to understand instruction, and time allocated to learning). Walberg's learning metric is missing two components of Carroll's model (aptitude and perseverance), resulting in further research to identify each of Carroll's constructs' significance. Carver (1970) found a positive correlation among college students between learning time and the amount learned while controlling for learning ability (r = .30). Carver (1970) also found an inverse correlation between learning ability and learning time (r = -.42). This study demonstrates that each of Carroll's constructs was associated with learning (aptitude, OTL, perseverance, quality of instruction, and ability to understand instruction) (Carroll, 1989).

The existing literature on low-level literacy focuses on adult cognitive abilities necessary for reading comprehension (Tighe & Schatschneider, 2016). However, previous research has established that the length of time in an academic day and the number of hours spent doing homework only predicted success (Coleman, as cited in Frederick & Walberg, 1980). Furthermore, results from a meta-analysis of 20 studies suggested that time spent learning had a

negligible effect size meaning that factors other than time are more strongly associated with learning (Cohen, 1988, as cited in Cook, Levinson, & Garside, 2010).

Leinhardt (1975) (as cited in Frederick & Walberg, 1980) combined four-time constructs—attendance, time spent reading, time spent on math, and time spent in extensive instruction—to develop an opportunity for OTL measurement like one of Carroll's constructs. OTL is time allocated to learning within Carroll's Model of School Learning. The Leinhardt-Cooley Model (1975), a multi-variable model like Carroll's, researched school practice and performance outcomes. Their prediction variables were an academic achievement and attitude (school, friends, and teachers). They further defined OTL as the time in each content area that the student spent (Cooley & Leinhardt, 1975, as cited in Frederick & Walberg, 1980). In addition, they viewed internal and external motivating variables, such as teacher praise, class activities, and instructional materials, as factors affecting time allocated to learning or OTL. According to Leinhardt and Cooley (1975), academic achievement and attitude affect school performance and ability. Leinhardt's research involved creating a single index to represent time. The time factor consisted of attendance, time spent reading, time spent on math, and time spent in large group instruction. The time index represented as OTL was positively correlated with achievement ($r = 0.20$) (Frederick & Walberg, 1980). Leinhardt further declared that; the "prior level of achievement accounted for 83 percent of the output variance, and the process variables explained an additional 5 percent of the regression predictions" (Frederick & Walberg, 1980, p. 188).

Some studies have established that ABE programs cannot be evaluated by any single isolated measure (Venezky, Bristow, & Sabatini, 1994). The empirical research on improving reading reveals that other factors affect learning outcomes in ABE programs more than

instructional hours alone. Venezky et al. (1994) tested 92 ABE adult learners through computer assessments at three separate intervals in repeated testing. The different testing simulations were conducted with various "norm-referenced reading and mathematics tests as well as with tests of reading rate and decoding developed for [their] study" (Venezky, Bristow, & Sabatini, 1994, p. 101). The researchers discovered that score changes varied between each examination. The scores increased and decreased for participants. "No significant difference in score changes were found for the amount of instructional time for attendance rate, and a large amount of group heterogeneity was revealed through an analysis of growth patterns" (Venezky, Bristow, & Sabatini, 1994, p. 101). The researchers go on to add that;

> in populations smaller than 200, aggregating grade equivalency scores can lead to distorted mean changes than aggregate means of equal-interval scale scores. In contrast, regression simulations to the mean caused by guessing on multiple-choice tests showed that this effect was small. (Venezky, Bristow, & Sabatini, 1994, p. 101)

The evidence suggests that measuring reading alone through standardized assessment is not equal between assessments (Venezky, Bristow, & Sabatini, 1994). Venevzky, Bristow & Sabatini (1994) indicated that a single reading score is inadequate for assessing student change in adult literacy programs.

The Complexity of Reading and Difficulties in Assessing

Tighe and Schatschneider (2016) compared 16 independent studies, including 2,707 participants, to determine reading comprehension effect on reading ability. They found that six constructs were correlated with reading comprehension (average $r_s \geq .50$), including (a) morphological awareness, (b) language comprehension, (c) fluency, (d) oral vocabulary

knowledge, (e) actual word decoding, and (f) working memory (Tighe & Schatschneider, 2016). Tighe and Schatschneider (2016b) followed with another study identifying three of the six previously presented constructs as having moderate associations ($.30 \leq r_s \leq .50$) with reading comprehension for adult learners.

Tighe and Schatschneider (2016b) concluded that morphological awareness, pseudoword morphological awareness, and vocabulary knowledge compose the simple view of reading (SVR). The SVR refers to the empirical results concluded from their structural equation model (SEM) results. Upon reviewing two and three-factor structural equation models, they determined that three of the six previous constructs were the best fit and accounted for 79% of the reading comprehension variance (Tighe & Schatschneider, 2016b).

When the additional emphasis was placed on vocabulary knowledge in ABE programs, that adjustment accounted for an additional 5.6% variance ($p = 0.052$) (Tighe & Schatschneider, 2016b). Vocabulary knowledge can be improved through teaching phonological practices such as decoding. Decoding is when the adult reader can letter-sound, analyze, and identify sounds of letter combinations within words (Chall, 1983; Ehri, 1999, as cited in Barnes, Kim, Tighe, & Vorstius, 2015; Mason, 1980). Reading strategy is developed in stages. The first stage is understanding word parts (morphological). After understanding word parts, the next stage for reading is letter positioning (orthographical). The third stage of reading comprehension is combining the first and second stages. The last stage of reading comprehension recognizes sounds in spoken language related to written words (phonological). According to Barnes et al. (2015), the four stages of reading comprehension integrate into one to determine the reading comprehension skill level. Other researchers further define the ability to read in similar stages.

Theoretical Framework: Carroll's Model of School Learning

The Carroll Model of School Learning describes the degree of learning as a function of time spent learning divided by the time needed to learn (Hymel, 1974). This study will calculate a new metric of learning: a number that would quantify the degree of learning to predict success in ABE. I will analyze the relationship between the metric of learning and post-test scores while controlling for age. Carroll (1963) listed five major learning factors: (a) opportunity, (b) perseverance, (c) aptitude, (d) ability to understand instruction, and (e) quality of instruction. The model displayed in chapter one illustrates Carroll's Model of School Learning as a functional equation. This section of chapter two includes sources and instruments that will be the basis for operationalizing each of the five of Carroll's Model of School Learning variables.

Research Using Carroll's Model of School Learning

Several studies have examined the link between time and learning (Carver, 1970; Carroll & White, 1973: Cook, Levinson, & Garside, 2010; Cooper & Pantle, 1967; Crai & Tulving, 1975; Gettinger, 1984; Meehan & McCallig, 2018; Piccone, 2006; Reed, 2015; Sjorgen, 1967; Venezky et al., 1994). Tracing studies on the effects of time on learning takes us back to Carroll's Model of School Learning (1962); and is believed to apply to any type of learning (formal or informal) (Nix, 2000). A study of 182 instructional hours for 2,055 students' results was analyzed after publication to determine that increased test-taking ability may impact learning gains (Metis Associates, 1991). A meta-analysis of 28 ABE assessment progress studies on instructional time and learning revealed a robust variance in learning related to time (Ziegler & Ebert, 1999). The 28 studies ranged from 7 hours to 300 hours (Ziegler & Ebert, 1999). The grade-level learning gains presented in Ziegler and Ebert's (1999) meta-analysis ranged from 0.2 to 1.5. The average time of instruction of the 28 studies was 89.6 hours, with an affected grade-

level learning gain, as assessed with an ABE-approved test, which was 0.98 (Ziegler & Ebert, 1999). The impact of various amounts of time has resulted in mixed results.

Carroll (1963) demonstrated that time was a significant factor in learning. Academic success for Carroll was interdependent when a person actively engaged in learning a task and the time one spent engaged in learning. Carroll (1963) validated three learner characteristics unique to everyone: aptitude, ability to comprehend instruction, and perseverance. Two additional constructs are out of the learner's control: the OTL and the quality of instruction (Carroll, 1963). These five constructs are considered with a study of adult learners attending a program to qualify to take the GED® through identifying the degree of learning for each study participant and statistically measuring that figure against the post-test TABE 11 or 12 score.

Constructs of Carroll's Model of School Learning

Opportunity to Learn

The OTL for this study refers to a measure of 15-minute increments of instructional time in formal Adult Education settings that are reported as instructional hours for any ABE program (NRS, 2019). Carroll's Model of School Learning categorizes the OTL as an instructional variable. Throughout this study, the term instructional time will be used interchangeably with an OTL (Carroll, 1963). "This construct can also be associated with the instructor's dedicated time for each instructional lesson" (Haertel, Walberg, & Weinstein, 1983, p. 78). Previous research on a sample of 2,300 ABE students from 200 classes in 90 ABE programs in 15 states showed that it took five months of attendance to make one-half of a level gain (Kent, 1973, as cited in Mikulecky, 1986). In an analysis of several military studies, Sticht (1982) found that 80 to 120 hours of instruction were needed for an entire grade level gain. In modern ABE programs, two grade levels encompass one NRS level. Therefore, at 80-120 hours of learning per level gain, it

may take 160-240 hours to achieve two-grade level gains or one NRS level gain. Of the five variables of Carroll's Model of School Learning, the OTL is the attending adult learner's discretion. ABE teachers have long believed that irregular attendance--not utilizing the OTL--is the main challenge for completing ABE. One study claimed that 85% of surveyed ABE teachers cited irregular attendance as the primary reason for failure (Darkenwold & Valentine, 1969, 1986).

Aptitude

Aptitude, a construct in Carroll's Model of School Learning (1963), is defined as prior learning (Nix, 2000). For this study, the concept of aptitude is defined as the last grade completed before enrolling in Adult Education. The amount of education completed before dropping out has focused on previous research. Therefore, it will serve as the variable to be placed in the denominator in the place of aptitude. The literature reviewed for this study noted that Hyman, Wright, and Reed (1975) studied 54 national surveys or 80,000 responses to find that a higher level of schooling correlated with greater knowledge (r = .26).

Hyman, Wright, and Reed (1975) found that 95% of the 250 knowledge items assessed showed pronounced effects based on the years of schooling. They also concluded that more years of education equaled higher levels of reading. Therefore, aptitude will be calculated by Carnegie Units of 120 hours per grade level completed. For reference to this interpretation of aptitude, let us look at the rate of time calculated for secondary school, *Carnegie Unit*. Since this study's population consists of primary and secondary school dropouts, their aptitude for learning would be 120 hours for a first-grade dropout up to 1,440 hours for a 12th-grade completer of high school. The range of 120 to 1,440 hours will be inserted into each study participant's function based on the final grade level completed before school dropout.

Perseverance

Another variable in Carroll's model is *perseverance*, which refers to the percentage of time spent learning (Haertel, Walberg, & Weinstein, 1983). For this study, the conceptual framework of perseverance is stipulated by ABE regulations. NRS regulates the enrollment point for a program to start being measured for outcomes related to the ABE participant (12 hours) and subsequent expected post-test or outcome rate through what is referred to as a Period of Participation (PoP). The PoP is a 90-day cycle that starts upon the 12th hour occurred. Perseverance or the percentage of time spent learning will be calculated based on the total time attended in the PoP, that is, instructional time in PoP divided by lifetime hours of enrollment.

Multiple measurable skill gains are essential to note because programs can be credited for adult learner outcomes of none, one, or multiple measurable skill gains (MSG). Programs can earn multiple MSG for each PoP until program completion. For example, adult "A" enrolls in the program with a 530 in Reading, 530 in Math, and 545 in Language. Adult learner "A" is labeled as an NRS Level 3 in all areas. Within the first PoP, the adult attends class for 40 hours and retests. The retest scores are 536 in Reading, 517 in Maths, 530 in Language, an improvement in Reading, and a decline in math. The ABE program will receive one MSG for Reading because of the increased score range for an NRS Level 4 (536-575). After the 536 in Reading, the adult can start the GED® testing series. If the learner "A" continues to attend beyond the 90-day PoP, a second PoP begins. An alternate scenario is that a learner "A" achieves a GED® within the first 90-day PoP; then, the ABE program will receive multiple-MSG credit. All multiple MSGs are tracked over a three-year ongoing average as an incentive funding metric.

Ability to Comprehend Instruction

Carroll's variable *ability to comprehend instruction* is defined as general intelligence. The current practice in ABE is to administer a locator assessment to identify the rigor of instruction. Using the current practice to identify the rigor level will be the basis for identifying the ability to comprehend instruction in Carroll's Model of School Learning. This construct will be based on the TABE Locator score taken during enrollment into the program. The Locator level is set to one of five levels. These five levels should not be confused with the pre-test TABE scale score; each level has a correlating TABE 11 and 12 tests. The lowest level, Level L, and the other levels (E, M, D, and A) are designed so that each adult learner has an assessment written at the level of rigor or difficulty that correlates to their level of comprehension. Within Carroll's model, the ability to comprehend instruction is in the denominator and is multiplied against the quality of instruction. The TABE Locator level of rigor will be inserted following current practice in this study.

Quality of Instruction

The last construct of Carroll's Model is the *quality of instruction*. Hymel (1974), in his *Investigation of Carroll's Model of School Learning as a theoretical basis for the organizational structure of schools*, found a significant interaction effect between the quality of instruction and the ability to comprehend instruction. Other researchers have argued that an adult learner does not control this construct (Haertel, Walberg, & Weinstein, 1978). This construct is operationalized as the *Effective and Efficient* (E & E) rating calculated per instructor. The E & E is a quantifiable figure available for each instructor within an ABE program that uses LACES. The instruction quality is based on the PoPs (denominator) divided by the MSG plus GED® (numerator) earned in the adult learner population that received instructional services from that

instructor. Currently, E & E is a measure used to assess the effectiveness of an instructor. As a collective, the program's effectiveness is based on E & E. In Carroll and Spearritt's (1967) controlled variable experiment of 208 six-grade youth, quality of instruction significantly impacted learning. In addition, the quality of instruction affected the motivation of student learners (Carroll & Spearritt, 1967). The researcher's 3 x 2 x 2 factorial design study revealed that learning is equally inefficient when the quality of instruction is inefficient (Carroll & Spearritt, 1967). The three-factor study variation conducted by Carroll and Spearritt (1967) studied 12 group interactions to reveal that the quality of instruction had the most effect on the learning. Carroll would later reflect those researchers who furthered his studies, such as Bloom (1968), who achieved criterion objectives of learning by increasing the ratio of time spent needed, either through more hours spent learning or by decreasing the hour needed to learn (Carroll, 1989). Carroll added that the quality of instruction and improving student motivation might result in better learning.

Control Variable

Based on another ABE study conducted in 2006, age will be a variable controlled for in the study. Jason Piccone (2006) analyzed TABE testing in a correctional setting to determine the optimal time to administer the TABE. Piccone (2006) studied 1990 to 2005 data (n=1,825) from Virginia's Department of Correctional Education database. He analyzed TABE scores upon intake to prison and six months later without formal instruction; a significant main effect indicated that age was related to TABE scores, $F(3, 1796) = 17.20$, $p < .001$, partial eta2 = .028. The younger inmates scored better on TABE than the older inmates (Piconne, 2006). Tukey post hoc tests showed significant differences in TABE scores between 27-34 and 42-71. A significant inverse correlation was found between age at the first test and the first TABE score (r = -.18).

Similar findings indicated a significant inverse correlation between age at a second test and the second TABE score (r = -.21). Piccone (2006) identified an interaction between time and age, suggesting that younger participants demonstrated greater improvement in TABE scores, $F(3, 1796) = 2.91$, $p < .05$, partial $\eta^2 = .005$.

Challenging A Model of School Learning

Sjorgen (1967) experimented with Carroll's Model of School Learning with 208 adult participants. In the first study to test Carroll's Model of School Learning, Sjorgen (1967) explored whether different time-related factor conditions in learning interacted with age (Sjorgen, 1967). Sjorgen calculated the *time spent learning* (TSL) ratio to the *time to learn* (TTL). Sjorgen (1967) developed a reference for TSL to TLL from the study results. Cook et al. (2010) conclude that time accounts for over one-fourth of the variance in learning outcomes ($R^2 = 0.28$).

Carver (1970) assessed the relationship of time to learn to the ability to learn. This experiment of 48 college students linked three of Carroll's Model of School Learning (1963) constructs: quality of instruction, ability to learn, and time spent on learning (perseverance). Carver (1970) found a positive association among college students between learning time and the amount learned while controlling for learning ability (r =.0.30. Carver's (1970) results support the use of three of Carroll's Model of School Learning variables, including one numerator from the degree of learning (perseverance) and two denominators from the degree of learning (quality of instruction and ability to learn).

Carroll and White (1973) applied Oldfield and Wingfield's (1965) picture-naming latency in 37 adults with 94 stimuli study to follow Carroll's original work. They studied how adults recall images verbally by identifying objects (Carroll & White, 1973). They found that the

age when a word is learned is the chief determinant of naming, meaning that the earlier in life a word is learned, the quicker it is recalled (Carroll & White, 1973). They also found that words are stored chronologically rather than through frequency, meaning that the building blocks of reading are recalled from the time they were learned, not the frequency the word was exposed to (Carroll & White, 1973). Both findings impact our understanding of the reading ability of school dropouts as they relate to the age at which they stopped attending compulsory education. The age when the adult learner learns the word impacts the quickness to recall the word has written form. The early life of the adult learner impacts the reading ability (Carroll & White,1973). These results further support considering factors other than classroom time alone to assess the adult learner's reading score. Some adult learners, typically from a middle-class family, were exposed to words earlier in life than an adult learner who was raised in poverty. Based on the results of Carroll and White's study (1973), I conclude that the speed of recalling the words in a reading passage during testing determines the amount of time remaining (lower-speed word recall ability vs. higher-speed word recall ability).

Gettinger (1984) studied TSL and the TTL, the basic components of Carroll's model. Based on this study's results, the author disagreed with Carroll's ideas. According to Gettinger, TTL contributed significantly to learning and had a more direct effect than TSL (Gettinger, 1984). This study's different factor is that the sample consisted of children, whereas studies that supported Carroll's work focused on adults. In addition, Gettinger's (1984) reports on other studies on time use in instruction were inconsistent. According to other research, the effects of TSL are minor (Karweit, 1980). Moreover, Frederick and Walberg (1980) resolved that TSL is only a modest predictor of learning.

According to conventional wisdom, Carroll (1989) acknowledged that two learners would not have the same aptitude to learn. Each adult's prior knowledge and reading experience in the classroom varies widely. Early research in Adult Education emphasized that past and present experiences in education and motivation were signifiers of achievement (Walberg & Tsai, 1983). Nix (2000) addressed this matter by controlling the experiment for prior learning in his study of Carroll's variables on math achievement in urban, suburban, and rural high schools. This finding implies that prior learning will not be controlled but reported as a numerical calculation from Carnegie Units' total. If a person graduated secondary school less the Carnegie Units, they obtained through completing an identified grade level.

Model of School Learning in Recent Years

More recently, Nix (2000) explored Carroll's Model of School Learning to predict student growth. According to Nix (2000), an adult's ability to learn is founded on the assimilation of intelligence and understanding instruction. From Nix's vantage point, the ability to learn can be estimated by the last grade completed, though it depends on whether the adult has a learning disability.

Aligning instruction to the adult's learning stage is key to providing quality instruction (Carroll, 1963). Hernandez-Gantes (1995) reported a moderate effect of learning based on the quality of instruction. Another factor in the quality of instruction is feedback (Cook, Levinson, & Garside, 2010). Providing adult learner feedback added to the adult learner's amount of time in the learning environment (Koop, Stark, & Fischer, 2008). These studies support the belief that attendance will be more consistent in a classroom with quality instruction. In Carroll's model, persistence in attending ABE classes functions as a numerator variable. Quality of instruction is a denominator variable; the quality of the instruction may be evident in the final product of the

degree of learning. Since there have been studies assessing the attendance rate compared to the quality of instruction, support for using that variable in Carroll's Model of School Learning is evident.

Research Question

1. Does Carroll's Model of School Learning account for additional variance in TABE 11 & 12 scores beyond instructional time after controlling for age?

   Hypothesis 1: Carroll's Model of School Learning accounts for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age.

Study Weaknesses Revealed in the Literature Review

In this study, I will analyze an area that has not been previously studied. Few studies have linked Carroll's Model of School Learning to ABE. The general notion has been that 100-150 hours are required to increase the NRS level (Mikulecky, 1987; Sticht, 1982). Previous studies, however, have not reported data to support the need for 100-150 hours of instruction needed to increase reading capacities (Venezky, Bristow, & Sabatini, 1994). The literature's weakness is the disconnection between self-reported time logs in current use and the variety of time recording measures in each of the studies reviewed. Instructional hours as a linear function vary between settings because the timeliness in engaging in learning is not precise. The current instructional hours reporting practice (sign-in and sign-out sheets) lacks precision in reported instructional hours compared to actual hours engaged in learning.

Summary

Carroll's work has had a significant impact on learning research; he was one of the first to posit that time was paramount to learning (Nix, 2000). Since Carroll (1989) believed that his model applies to any learning task, this study may affect ABE. Improving reading ability takes

time. Adult learners need to engage in daily reading to improve their reading ability. The ABE participants may have to spend years mastering reading, especially the vocabulary required to pass the test. Low literacy adults (NRS Level 1 – 4) need to engage in instructional hours to improve their reading (Greenberg, Ehri, & Perin, 2002; MacArthur, Konold, Glutting, & Alamprese, 2010). Other research centered on studying how adults read later in life, which contributed to the field by identifying the functions and processes needed to become a better reader (Robinson, 2018). Word recognition and word knowledge were identified by Robinson (2018) as key to improving reading for adult learners, as cited in an experimental study of five prisons ABE programs using a reading instruction curriculum compared to an ABE prison reading program. In most research, time in an instructional setting has been a good predictor of learning effects at an ordinary level (Frederick & Walberg, 1980). There is a general belief in Adult Education that one minimum instructional hour requirement is ideal for all levels of adult learners. This idea is founded on the publisher's testing guidelines to prevent a practice effect (DRC, 2018). Practice effect can occur through repeated exposure to the same assessment. As a result, the test taker does not improve the score due to learning more information outside of the assessment but by retaining more information about the test questions. Since TABE 11 and 12 change very few questions on the assessment, other than piloting questions in the math assessment, a practice effect is likely to occur from repeated exposure. The DRC published validity report does not refer to the time between pre-testing and post-testing (DRC, 2018). DRC did specify each subcomponent of the assessment it takes to complete (DRC, 2018). The published DRC information available to the TABE 11 & 12 sets the minimum testing times to avoid the practice effect (DRC, 2018). DRC does not consider any adult learner learning factors in formulating the recommended pre-test and post-test times regulated in Arkansas ABE.

The literature review detailed some of the cognitive processes occurring as a person processes information from reading. For example, an ABE participant reading at NRS Level 2 has shown a need for a more considerable amount of instructional time to learn how to read fluently. The level 4 learner is held to the exact instructional hour requirement, although the skill deficit may take less than the minimum instructional hours. For example, the Level 4 adult learner may need help identifying a selected reading passage's main idea. In contrast, the Level 2 adult learner may need help identifying the subject and action in a sentence. Each adult learner's varying needs have not been considered if the institution enforces a single standard of post-test instructional hours. This literature review connects the study of the effects of time on learning on adults' learning needs by taking the reading TABE 11 & 12 assessment (Frederick & Walberg, 1980; Venezky et al., 1994).

In conclusion, adult educators' instructional intervention in ABE programs throughout America makes instructional planning determinations on TABE score data and the adult learners' specific capabilities. There are many factors in properly aligned instruction and resources for adult learners of basic literacy. Adult education settings often lack empirically-based standardized curricular materials (Lesgold & Welch-Ross, 2012, as cited in Tithe & Schatschneider, 2015). However, instructors make instructional decisions based on experience, professional judgment, and instinct. As a result of this study, it will be possible to develop an improved method of determining post-test readiness in Reading due to the time-consuming decisions ABE instructors have to make routinely in their daily duties.

Chapter Three: Methodology

This study aims to determine if a better model exists to assess ABE learner readiness to post-test. Specifically, the goal is to evaluate whether the metric, degree of learning, of Carroll's Model of School Learning can predict TABE 11 and 12 scores to see if it is a better predictor than instructional time. This chapter aims to introduce the methodology of this quantitative study, including a brief description of the quantitative paradigm and research design. Following the research overview, I describe the study sample and instruments. The chapter details the research procedures and plans for data analysis. Finally, the chapter also comprises the ethical considerations and plans for presenting the results.

Research Methodology

This study aims to determine if Carroll's Model can be used to predict post-test scores in ABE. A multiple linear regression analysis serves the interest of this study because it allows for the partitioning of variance in the outcome (post-test scores in ABE) to multiple explanatory variables. Multiple linear regression yields statistical analysis for the effect of "several factors concurrently" (Schroeder et al., 1986, p 29). The variation between the degree of learning on post-test scores can be systematically analyzed, and the effect of instructional time on the same post-test score while controlling for age (Schroeder et al., 1986).

Research Question

Does Carroll's Model of School Learning account for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age?

Hypothesis 1: Carroll's Model of School Learning accounts for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age.

This study's hypothesis presumes a better model for determining post-test readiness for the TABE 11 & 12 Reading Test. Chapter one presents the research question $H1_0$: Carroll's Model of School Learning does not account for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age.

$H1_A$: Carroll's Model of School Learning accounts for additional variance in TABE 11 and 12 scores beyond instructional time after controlling for age.

Research Design

I will use a non-experimental cross-sectional design with secondary data in this study. I will construct a dataset using existing data from state ABE centers to build explanatory models illustrating how instructional time and Carroll's Model of Learning account for variation in adults' post-test scores. This design will allow me to examine whether Carroll's Model of School Learning can better predict ABE than instructional time.

Measures

A metric of the degree of learning will be calculated for each adult learner in the study. The metric is based on Carroll's model of school learning. The numerator in the metric (OTL) is multiplied by the percentage of time spent engaged in learning. The denominator is a two-part calculation: first, the quality of instruction is multiplied by the ability to understand instruction. Second, that solution is multiplied by the time needed to learn. The degree of learning metric is the solution from the numerator divided by the denominator.

Carroll's Model of School Learning allows the degree of learning to be presented in quantifiable terms. First, the numerator—the time allocated to learning—refers to instructional time hours in the classroom. The percentage of time spent engaged in learning will be calculated

using the total time allocated divided by the available classroom time in one 90-day duration. The numerator may appear in quantifiable terms as 150 x .50 = 75.

The denominator is calculated using two equations. The first is the quality of instruction multiplied by the ability to understand instruction. The quality of instruction is derived from the effective and efficient rating of the ABE program (E & E); it is a percentage of adult learners making measurable skill gains from each ABE program. Understanding instruction is measured using the pre-test score for adults enrolled in the program (translates to comparable grade level equivalency commonly used for instructional planning). The first equation may appear as 0.47 x 500 = 235. The second equation in the denominator indicates the time needed to learn. This figure is derived from the Carnegie Units missing from the last grade level completed by the ABE participant. For example, if a 10th-grade dropout misses 240 Carnegie Units (120 per year from 11^{th} and 12^{th} grade), the equation will use 240 Carnegie Units multiplied by the first denominator equation (235): 240 x 235 = 56,400. For the final calculation, 56,400 will be divided by 75, which equals 0.00132979. Calculations will be used without rounding until all the study participants are figured out. The figure of 0.00132979 is the metric for the degree of learning for this participant. The previous steps are how the study's independent variable will be calculated. The test instrument is entirely developed and static, so the variable data will be extracted from the database once the study is approved. This process will continue until the minimum sample size of 92, required for strength analysis, is reached or surpassed. Once data collection is complete, the multiple linear regression analysis will begin.

Participants and Sampling

The target population for this study includes people in the State of Arkansas who were enrolled in ABE. The whole target population is accessible with permission for the entire

database for Arkansas. The study involves using a single-stage sampling procedure. This design was selected because of my direct access to the data set. As noted in Chapter 1, each adult education program reports quantifiable enrollee data to the USDE, OCTAE through the NRS via LACES (Literacy Pro Systems, 2020).

A power analysis I use G Power was conducted using A priori, F tests for multiple linear regression: Fixed model, R^2 deviation from zero. The input parameters were set to the effect size f^2 set at 0.15, err prob at 0.05, Power (1- err prob) at 0.80, and several predictors at three, accounting for the independent variable (IV) and dependent variable (DV) only. A determination was made that applying the above parameters, a minimum of 92 participants would be sufficient for the data collection.

The population sample data will be a stratified sample provided by the Arkansas Office of Skills Development, Division of Workforce Services, Section of Adult Education. The Division of Adult Education can access, sort, and collect all ABE program data. Subject data provided from the state database will be randomly chosen and assigned to this study. The *local education agencies* (LEA) with institutional review boards will need to approve the data usage, including each program's E & E rating. ABE programs in Arkansas report program data through LACES. Enrollment within LACES is stratified as NRS levels. Within the 2019-2020 program year dataset, each level's proportion relative to the total enrollment in ABE is displayed in table 1 below. The stratification of the sample population is listed alongside the statewide enrollment data. This study attempts to mirror the stratification of enrollment across the State. Within ABE programs, the key demographic is the participants' education functioning level (EFL). Therefore, the EFL is the basis for stratifying the sample population (**Table 4**).

Table 4*: Stratification of Sample Population Aligned to Arkansas ABE Enrollment*

NRS Level	State Enrollment (7,332) Participants: Percentage of Total	Stratified Sample Population (92) Participants
ABE Level 1	4%	4
ABE Level 2	33%	31
ABE Level 3	40%	37
ABE Level 4	23%	21

Note. This table demonstrates the composition of the total ABE enrollment for Arkansas for the 2019-2020 academic year.

The 92 randomly selected state participants will be directly proportional to the enrolled participants reported by the State of Arkansas to the NRS (Arkansas Division of Adult Education, 2021). Therefore, stratified random sampling will produce a more representative sample of the population (O'Dwyer & Bernauer, 2014). The stratified random sampling used for this study will be derived from the intake classification (strata). Since ABE consists of NRS levels 1 through 4, each level will be a stratum to be analyzed. The purpose of stratified random sampling is to be precise and lessen sampling errors. In addition, this process should narrow the weighted mean that reduces the arithmetic mean.

Data Collection

I will collect quantitative data by exporting information collected from the ADWS-AES. The information stored in the database is sortable and can be extracted in part or whole. For the sake of the study, student identification will remain anonymous. During the preparation for the data extraction, the sorted order will include (a) student identification number, (b) final grade level completed, (c) pre-test score, (d) post-test score, (e) intake date, (f) total instructional hours, (g) exit date, (i) program name, and (j) Locator level. The extraction process in LACES is

marked from the student view screen. Once the viewable data needed for the extraction is visible on the viewscreen, the export to a comma-separated value (CSV) is functional through an export icon on the viewer's screen. Finally, the CSV data will be uploaded to SPSS 26 for data analysis.

Instrumentation

The instruments used to collect testing data are TABE, 11, and 12. The test results are housed on the publisher's website (DRC). From DRC's website, the test scores auto-populate into LACES. From LACES, the testing information is stored in a per-person profile that includes personal data collected through the intake application. Each ABE participant completes that intake application upon intake, using a standardized format designed by the Arkansas Division of Adult Education Services.

The testing instrument is recognized as an approved assessment instrument by the U.S. Division of Education. Approval for its use as an assessment instrument required statistical testing. The DRC implemented item-response theory selection and scaling to test reliability and validity (DRC, 2017). The two-parameter partial credit model was used for polytomous scored items in the development of TABE 11 & 12 (DRC, 2017). In addition, a predictive validity test was provided by DRC (DRC, 2017).

The scores on TABE 11 & 12 are reliable and consistent, as reported by the TABE 11 & 12 developer DRC. For example, the Reading assessment has a Cronbach's coefficient Alpha of 0.84 to 0.90 (DRC, 2017). In addition, the Feldt-Raju reliability coefficient is reported for reading test items with selected-response and polytomous items (DRC, 2017).

Subcomponents of the TABE 11 & 12 Reading assessment at the various exam type levels are noted as non-proficient, partial-proficient, or proficient based on the number of correct answers in each category. The combination of correct answers from each subgroup is the basis

for the TABE 11 & 12 Reading assessment score the examinee receives. As the TABE 11 & 12 assessment was developed, DRC used a two-parameter logistic model for dichotomous scored items (DRC, 2017).

Data Analysis

The raw data will be uploaded into *the International Business Machines* (IBM) *Statistical Package for the Social Sciences* (SPSS) for Windows. Participants missing data for Carroll's Model of School Learning or TABE Reading scores will be removed from the further descriptive and inferential analysis. Instead, descriptive statistics will be used to summarize categorical and continuous-level data.

I will use a hierarchical linear regression to address the research question to explore the predictive relationship between Carroll's Model of School Learning and success in ABE. Hierarchical linear regression is appropriate when assessing a predictive relationship between independent variables on a continuous criterion variable while controlling for additional factors (Tabachnick & Fidell, 2013). The predictor variable will correspond to Carroll's Model of School Learning. The criterion (dependent) variable will correspond to post-test scores. The control variables will correspond to age and instructional time. Control variables are used to "neutralize the effects of variables that are not of central concern to the study" (Shavelson, 1996, p. 14). Age and instructional time will be continuous variables.

Applying the hierarchical regression technique, I will enter the variables into the model in two steps. In step one, the control variable of age will be entered. In step two, Carroll's Model of School Learning will be added to the model. The goal is to assess whether the model accounts for additional variation in post-test scores with the addition of Carroll's Model of School Learning beyond what the covariates alone can explain. The change in R^2 between the steps will

identify how much additional variance can be explained by incorporating Carroll's Model of School Learning into the model.

According to Laerd (2018), the following assumptions should be verified before running the hierarchical linear regression:

1. There should be one criterion variable that is measured at the continuous level.
2. Two or more predictor variables should be measured at the continuous or nominal level.
3. There should be independence of observations.
4. There should be a linear relationship between the predictors and the outcome.
5. There should be homoscedasticity of residuals (equal error variances).
6. There should be an absence of multicollinearity.
7. There should be no significant outliers.
8. The residuals (errors) should be normally distributed.

Assumptions one and two will be met due to examining a continuous dependent variable, success, and the inclusion of multiple predictors (age, education, instructional time, and Carroll's Model of School Learning). Assumption three, independent observations, will be checked with a Durbin-Watson test. Assumption four, linearity, will be checked with a scatterplot between Carroll's Model of School Learning and success. Assumption five, homoscedasticity, will be checked with a residual scatterplot. The absence of a clear pattern in the residual scatterplot will indicate that the assumption was met. Assumption six, the absence of multicollinearity, will be checked with variance inflation factors (VIFs). VIF values below ten will indicate that the assumption for the absence of multicollinearity was met. Assumption seven, the absence of significant outliers, will be identified through the standardization of Carroll's Model of School Learning and success values. Z-scores exceeding $\pm$ 3.29 standard deviations for either variable

will indicate outlying values, and these cases will potentially be removed from the regression analysis (Tabachnick & Fidell, 2013). Finally, assumption eight, normality, will be assessed with a normal P-P scatterplot. If the regression model's standardized residuals closely follow the normal trend line, the assumption of normality will be met.

The *F* test will determine whether there is a significant predictive relationship between the covariates, independent variable, and criterion variable (Field, 2013). The F test will also determine if the R squared value is statistically significant (Field, 2013). Individual *t*-tests will be used to assess the predictive ability of each independent variable. Unstandardized beta values will explain how success changes based on a one-unit shift in the predictor variables. Finally, I will evaluate the statistical significance of the regression analysis at the accepted level, $\alpha = .05$.

Ethical considerations

Before data collection begins, I will obtain permission from the University of Arkansas Institutional Review Board. The ABE participants must be aware that their privacy is protected: no results, individual or aggregate, will be traceable to a single person (Terrell, 2016).

Internal and External Validity

Internal validity cannot be effectively addressed before the study because it was collected before it was conducted. The sampling process can also threaten internal validity (O'Dwyer & Bernauer, 2014). Further, Cook and Campbell (1979), as cited in O'Dwyer and Bernauer (2014), stated that internal validity "refers to the approximate validity with which we infer that a relationship between two variables is causal or that the absence of a relationship implies the absence of cause" (p. 136). The following measures will reduce or eliminate threats to internal validity.

This study deals with subjects; therefore, subject characteristics threat does exist (O'Dwyer & Bernauer, 2014). Subject characteristics threat occurs when study participants are not equal; it implies that two groups are the same on all measured and unmeasured facets (O'Dwyer & Bernauer, 2014). Selection threats will be reduced or eliminated through random sampling.

O'Dwyer and Bernauer (2014) defined another internal validity threat, the history threat, as unplanned events that prevent study participants from being a part of the study's phenomenon. The historical threat in this study is that some of the data set from 2018 to 2019 was collected at other locations. Therefore, residual study participants in the database may be assessed at various locations for their pre-test and post-test. Testing at various locations could affect the quality of instruction within the degree of the learning model. ABE programs can conduct the intake test within 12 hours and provide pre-test instruction before assessment. Rarely are ABE participants transferred between programs from pre-test to post-test. When ABE participants are transferred between programs, the State is made aware of the transfer through a request process. The historical threat of intake testing in one location and post-testing in another was worth mentioning but unlikely to occur. Another historical threat would be an adult tester who took the previous TABE, the TABE 9 & 10, as a pre-test, then later post-tested in the TABE 11 & 12. I plan to avoid history threats by following O'Dwyer and Bernauer's (2014) suggestion to provide as much information detailing the study's conditions. The tests for 2018-2019 and 2019-2020 were conducted in the exact location—the location being used for this study.

A third internal validity threat relates to the study's instrumentation, namely that the TABE 11 & 12 data were entered into the LACES database in two separate ways. From July 1, 2017, to March 13, 2020, the TABE 11 & 12 scores were hand-entered by various data entry

staff for the program. Beginning March 16, 2020, the TABE 11 & 12 scores were auto-populated from the TABE 11 & 12 publisher, DRC, to LACES. This change in entry points from program-centered to off-site-centered must be acknowledged as a possible internal validity threat. Despite the auto-populate feature of TABE 11 & 12 to LACES, the data entry specialist has oversight and editing privileges for TABE 11 & 12 scores. The LACES database notates whether the TABE 11 & 12 score was auto-populated and if it was edited or revised.

Since I examined pre-test and post-test data in this study, a testing threat also exists as a threat to internal validity (O'Dwyer & Bernauer, 2014). A testing threat may occur because a second test follows the first test. The test publisher, DRC, did not conduct a pre-test to post-test validation because they were not likely to have a testing threat. This study uses a pre-test and post-test score comparison; therefore, it is worthwhile to mention this threat. The minimal threat will occur since the testing data analysis will occur after the fact. Also, the testing threat is reduced in this study because two alternate versions of the TABE will be considered: the TABE 11 series and the TABE 12 series. The alternate versions of the test are not required to be given in any order. The program chooses the order in which the two versions are given. The study population was tested using various combinations of the test. Specifically, some participants took version TABE 11, then TABE 12; some took TABE 12, then TABE 11. Per manufacturing guidelines, participants over 60 hours between the intake test and schedules post-test were allowed to take the exact version of the test twice.

Confounding variables cannot be accounted for, such as attention during instructional time and actual effort given during testing. ABE adult learners are recognized as more at-risk and transient, contributing to students separating classes. It is important to include students that withdrew or were administratively withdrawn from ABE programs because the results may

reveal critical information regarding these students. These threats will be discussed in more detail in chapter five as limitations.

A threat to external validity is the participants' characteristics, ABE programs, and the ability to generalize to other ABE programs. To control this, I will not look at specific ABE programs but instead at randomly assigned ABE programs or regions of the state. ABE programs exist in 36 other Arkansas locations and can use the results to have a baseline for reviewing their own students' success levels. Results are meant to be generalized to Arkansas ABE program adult learners or, at best, small, rural ABE programs with similar demographics of students and served by higher education LEAs.

Plans for Presenting the Results

After analyzing the data and testing the hypothesis, I will present all results in the dissertation report's Chapter 4 and Chapter 5. Additionally, a summary report detailing the study results will be developed and made available to the ADWS-AES officials, study participants, or concerned third parties (Terrell, 2016).

Summary

In this chapter, I discussed the research method for this study, where I will explore ABE data to answer the question: does Carroll's Model of School Learning predict TABE 11 and 12 scores better than instructional time? Based upon two predictors, one statistical test will be conducted on the data for an ABE population of 92 participants. The first question will be analyzed using binomial logistic regression. A non-experimental correlation design was chosen for this study. I will use cross-sectional data for the study's measures. This type of study has more internal validity threats than external validity threats. As discussed above, I will try to counteract each threat.

Chapter three contained an overview of the participants and sampling. The participants will be adult learners classified as reading below the ninth-grade level, as defined by ABE, enrolled in adult education services provided by the Arkansas Division of Workforce Services, Adult Education Section. Each participant has taken the same assessment instrument, the TABE 11 and 12. However, the participants will differ by final grade level completed, age, and instructional hours.

This chapter provides an overview of how the participant data will be analyzed. The first step will be to analyze instructional time correlates to post-test scores. The second step will be to add the degree of learning from Carroll's Model of School Learning to measure the change in R^2 to identify the additional variance that the model makes on the post-test score.

Chapter Four: Results

This study aimed to determine if there are better predictive factors of test readiness than those currently used. Specifically, the goal was to evaluate whether the metric, Carroll's Model of School Learning, can be used to predict TABE 11 and 12 scores better than instructional time. In this chapter, the findings of this study are presented. Descriptive statistics are used to summarize trends in the data. A hierarchical linear regression model addressed the proposed research question, and statistical significance was evaluated at the accepted level, $\alpha = .05$. This study's central research question was: Does Carroll's Model of School Learning account for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age? The study hypothesis was that Carroll's Model of School Learning accounts for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age. This chapter explains the data screening, data collection, and study results.

Pre-Analysis Data Screening

During data screening, thirty-two participants were removed from this study's initial sample (n = 135). Of these, 17 had no attendance for the program year, which would have resulted in a zero output for the *degree of learning*. Fifteen had completed secondary education, which would have also resulted in a zero output for the *degree of learning* because their *time needed to learn* was zero. Additional study sample participants were removed with zero hours of attendance during the study timeframe or an omitted last grade level of completion; both factors resulted in an incomplete function for the study model.

Standardized residuals were calculated for the remaining study participants ($n = 103$) to identify outliers. Of these, four had a *z-score* higher than 2.58 for their degree of learning. Eliminating values greater than 2.58 *z-scores* (99^{th} percentile) prevents descriptive and

inferential analyses from being skewed (Field, 2018). Therefore, after removing these cases, the final sample size was reduced to 99.

Data Collection

Data were collected from July 1, 2019, to June 30, 2020. Therefore, one deviation from the process outlined in chapter three was necessary. Chapter three explained that persistence was calculated using the frequency of attendance in 90 days of participation. Unfortunately, the dataset provided by the State of Arkansas did not include the frequency of attendance, as officials were unable to extract it from the statewide database. As a workaround, persistence was then determined by calculating the ratio of "lifetime hours" to "current fiscal year hours."

The individual participant demographics of the study sample were not included in the dataset; therefore, they are unknown. However, the sample was intended to be a stratified sample reflecting statewide enrollment for 2019-2020. Therefore, it is representative of the population of Arkansas ABE enrollees. Table 5 outlines actual and requested stratification (This study analyzed 1.4% of the participants in Arkansas for the 2019-2020 program year):

Table 5*: Stratification Percent of Sample Population to Arkansas ABE Enrollment*

NRS Level	State Enrollment (7,332) Participants: Percentage of Total	Requested Stratified Sample Population (92) Participants	Actual Stratified Sample Population (99) Participants
ABE Level 1	4%	$n = 4$, 4%	$n = 3$, 3%
ABE Level 2	33%	$n = 31$, 34%	$n = 36$, 36%
ABE Level 3	40%	$n = 37$, 40%	$n = 41$, 44%
ABE Level 4	23%	$n = 21$, 23%	$n = 18$, 19%

Results

Summary statistics were calculated for age, degree of learning, TABE pre-test scores, and TABE post-test scores. The average age was 38.08 years (SD = 13.04, Min = 19.00, Max =

64.00). The average instructional time was 302.38 hours (*SD* = 355.62, Min = 17.00, Max = 1823.75). The average degree of learning was 0.13 (*SD* = 0.18, Min = 0.00, Max = 1.01). The average TABE pre-test score was 503.94 points (*SD* = 37.61, Min = 404.00, Max = 597.00). The average TABE post-test score was 524.14 points (*SD* = 34.50, Min = 413.00, Max = 606.00).

Table 6*: Summary Statistics Table for Interval Ration Variable (Intellectus, 2022)*

Variable	*M*	*SD*	*n*	Min	Max
Age	38.08	13.04	99	19.00	64.00
Instructional time	302.38	355.62	99	17.00	1,823.75
Degree of learning	0.13	0.18	99	0.00	1.01
TABE pre-test scores	503.94	37.61	99	404.00	597.00
TABE post-test scores	524.14	34.50	99	413.00	606.00

Frequencies and Percentages

The most frequently observed ability to understand instruction category was Medium (*n* = 54, 55%). The most frequently observed category of a current level was ABE L3 (*n* = 41, 41%). Refer to Table 7 to summarize the frequencies and percentages of nominal variables in the dataset.

Table 7: Frequency Table for Nominal Variables (Intellectus, 2022)

Variable	*n*	*%*
Ability to understand instruction		
Easy	14	14.14
Medium	54	54.55
Difficult	27	27.27
Advanced	4	4.04
Current level		
ABE L1	3	3.03
ABE L2	36	36.36
ABE L4	18	18.18
ABE L3	41	41.41
ABE L5	1	1.01

Note. Due to rounding errors, percentages may not equal 100%.

Inferential Analysis

A two-step hierarchical linear regression was conducted to address the research question to examine the predictive relationship between the degree of learning and TABE post-test scores while controlling for age, instructional time, and TABE pre-test scores.

Research Question

Does Carroll's Model of School Learning account for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age?

Hypothesis 1: Carroll's Model of School Learning accounts for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age.

Age, instructional time, and TABE pre-test scores were entered as control variables into the first step of the regression model. The degree of learning was then added as a predictor variable into the second step of the regression model.

The following assumptions were verified before running the hierarchical linear regression:

1. Independence of observations: The Durbin-Watson statistic can range from 0 to 4, but the assumption is supported if the Durbin-Watson statistic approaches 2.00 (Field, 2018). The Durbin-Watson value was 1.66 for the hierarchical regression model, indicating that the assumption for independence was supported.
2. Linear relationships between the predictors and outcome: A series of scatterplots was created to examine the relationships between age, degree of learning, TABE pre-test scores, and TABE post-test scores (**Figures 2** & **3**). There appeared to be no relationship between age, instructional time, or degree of learning on TABE post-test scores. However, the relationship between TABE pre-test scores and TABE post-test scores appeared positive (**Figure 4**).

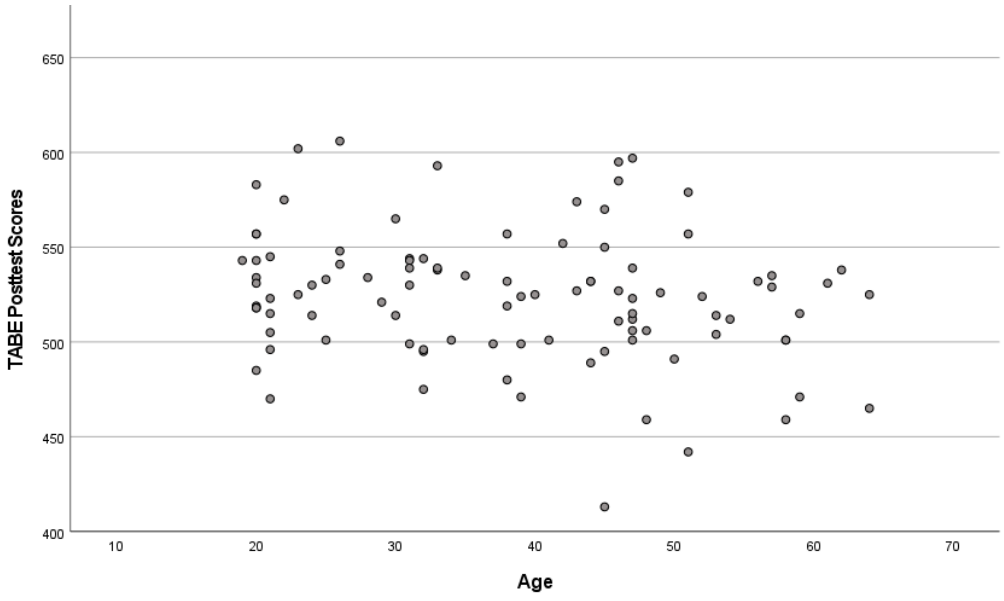

Figure 2*: Scatterplot Between Age and TABE Post-Test Scores (IBM SPSS, 2021)*

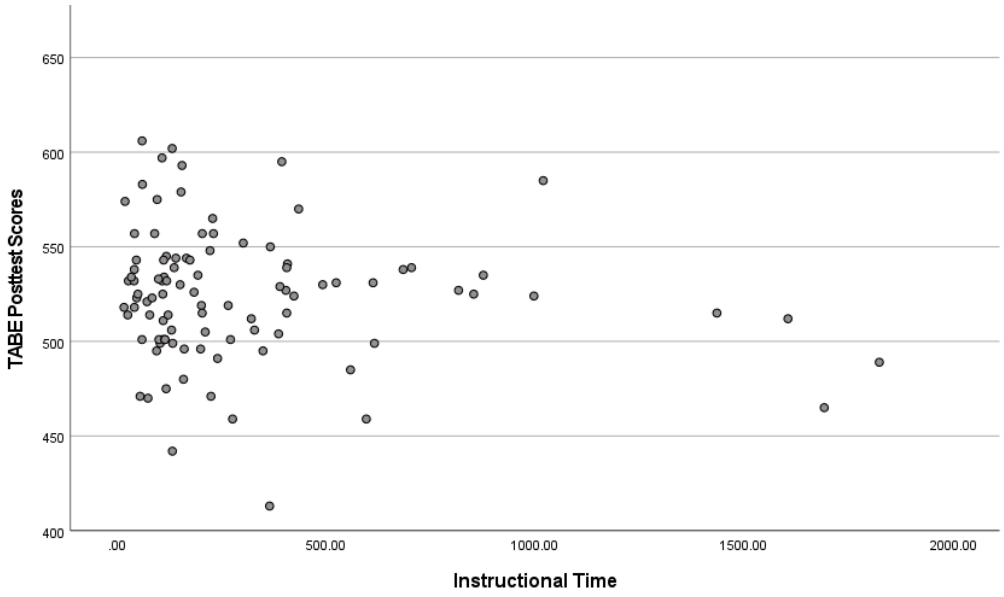

Figure 3: *Scatterplot Between Instructional Time and TABE Post-Test Scores (IBM SPSS, 2021)*

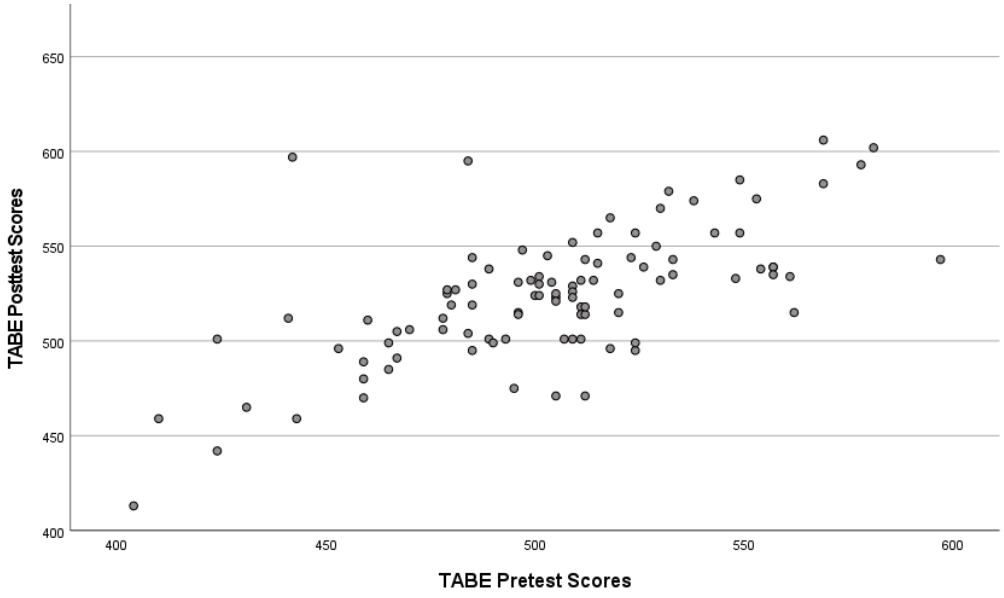

Figure 4: *Scatterplot Between TABE Pre-Test Scores and TABE Post-Test Scores (IBM SPSS, 2021)*

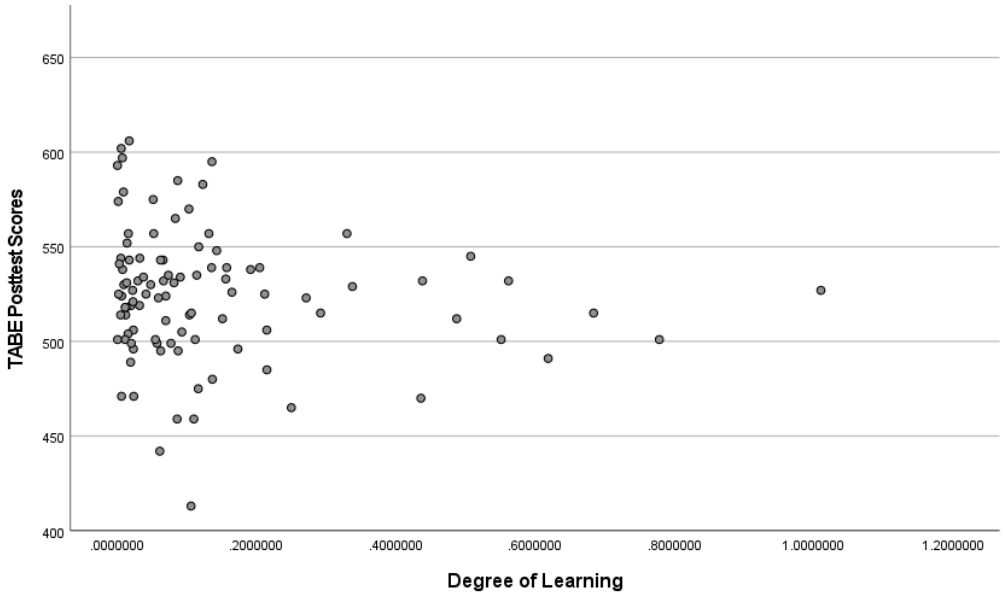

Figure 5*: Scatterplot Between the Degree of Learning and TABE Post-Test Scores (IBM SPSS, 2021)*

3. Homoscedasticity of residuals (equal error variances): The assumption of homoscedasticity was verified with a residuals scatterplot (**Figure 6**). The absence of a recurring pattern indicates that the assumption was supported.

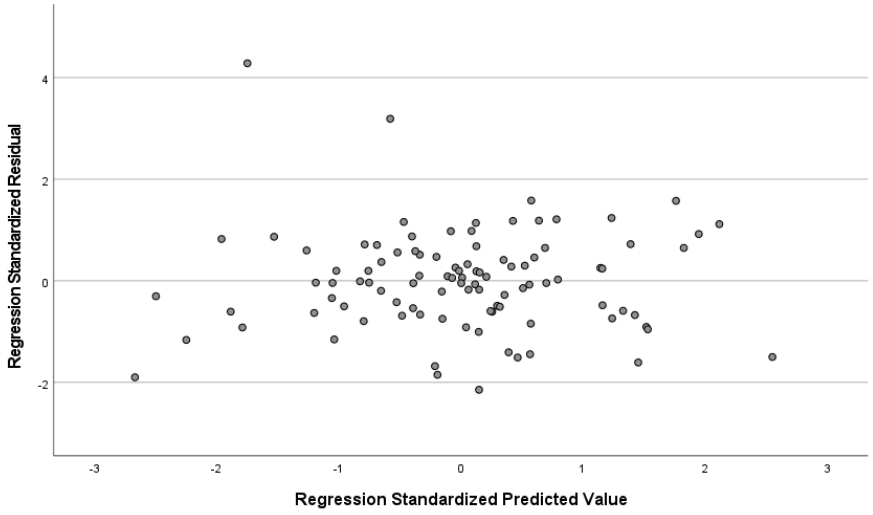

Figure 6*: Residuals Scatterplot for a Regression Model with Age, Instructional Time, TABE Pre-Test Scores, and Degree of Learning Predicting TABE Post-Test Scores (IBM SPSS, 2021)*

4. No multicollinearity: Variance Inflation Factors (VIFs) were calculated to detect the presence of multicollinearity between predictors for the regression model. Multicollinearity occurs when a predictor variable is highly correlated with other predictor variables. If a variable exhibits multicollinearity, then that variable's regression coefficient can be unreliable and difficult to interpret. High VIFs indicate increased effects of multicollinearity in the model. The VIFs greater than 5 are cause for concern, whereas VIFs of 10 should be considered the maximum upper limit (Menard, 2009). All VIFs fell in the acceptable range, indicating that the assumption for the absence of multicollinearity was supported (**Table 8**).

Table 8*: Variance Inflation Factors for Each Step (Intellectus, 2022)*

Variable	VIF
Age	1.23
Instructional time	1.28
Degree of learning	1.12
TABE pre-test scores	1.10

5. Residuals (errors) should be normally distributed: A normal P-P scatterplot was used to test the normality assumption (**Figure 7**). The data closely followed the normality trend line, indicating that the assumption of normality was supported.

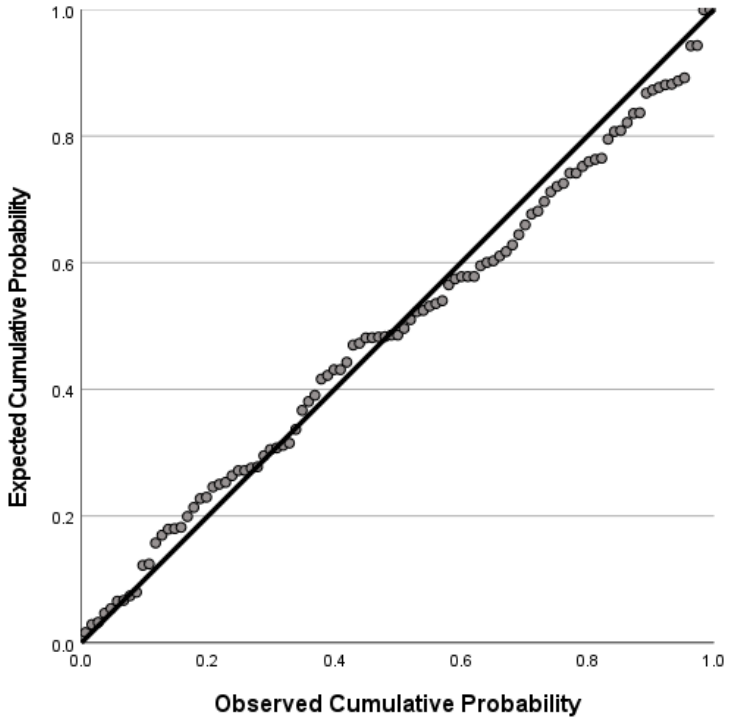

Figure 7*: Normal P-P Scatterplot for a Regression Model with Age, Instructional TIme, TABE Pre-Test Scores, and Degree of Learning Predicting TABE Post-Test Scores (Intellectus, 2022)*

Comparing Models. The hierarchical regression analysis results consist of model comparisons and a model interpretation based on an alpha of 0.05. In addition, the *F*-tests for the individual models and the R^2 change were examined.

Model 1 significantly predicted TABE post-test scores, $F(1, 97) = 24.90$, $p < .001$, $R^2 = 0.44$. Age, instructional hours, and TABE pre-test scores explained approximately 44.0% of the variation in TABE post-test scores. Model 2 also predicted post-test scores, $F(4, 94) = 18.48$, $p < .001$, $R^2 = 0.44$, but it did not account for additional variance beyond model 1, $\Delta R^2 = 0$, $F(1, 94) = 0.01$, $p > .05$ (**Table 9**).

Table 9: *Model Comparisons for Variables Predicting TABE Post-Test Scores (Intellectus, 2022)*

Model	R^2	*Numerator df*	*Denominator df*	*F*	*p*	ΔR^2
Step 1	0.44	3	95	24.90	<.001	-
Step 2	0.44	4	94	18.48	< .001	0.00
R^2 Change	-	1	94	0.92	.918	

Model Interpretation. In the first model, TABE pre-test scores predicted TABE post-test scores, $b = 0.60$, $t\ (df) = 8.15$, $p < .001$. TABE post-test scores increased by approximately 0.60 points for every one-point increase in TABE pre-test scores. Additionally, age and instructional time did not predict TABE post-test scores.

In the second model, TABE pre-test scores still predicted TABE post-test scores, $b = 0.60$, $t(df) = 8.00$, $p < .001$. However, the primary predictor of interest, degree of learning, did not predict TABE post-test scores, $B = 1.56$, $t = 0.10$, $p = .918$. Refer to **Table 10** for a summary of modeling output.

Table 10: *Summary of Hierarchical Regression Analysis for Age, Degree of Learning, and TABE Pre-Test Scores Predicting TABE Post-Test Scores (Intellectus, 2022)*

Variable	*B*	*SE*	95% CI	β	*t*	*p*
Step 1						
(Intercept)	230.00	39.52	[151.53, 308.46]	0.00	5.82	< .001
Age	-0.21	0.23	[-0.66, 0.23]	-0.08	-0.95	.343
Instructional time	0.004	0.008	[-0.01, 0.02]	0.05	0.53	.594
TABE Pre-test Score	0.60	0.07	[0.45, 0.74]	0.65	8.15	< .001
Step 2						
(Intercept)	229.17	40.54	[148.67, 309.66]	0.00	5.65	< .001
Age	-0.21	0.23	[-0.66, 0.23]	-0.08	-0.95	.346
Instructional time	0.004	0.008	[-0.01, 0.02]	0.04	0.50	.617
TABE Pre-test Score	0.60	0.07	[0.45, 0.75]	0.65	8.00	< .001
Degree of learning	1.56	15.16	[-28.55, 31.67]	0.008	0.10	.918

Summary

In this chapter, this study's findings were presented. Descriptive statistics summarize trends in the data. A hierarchical linear regression model was utilized to address the proposed research question. After controlling for age, instructional time, and TABE pre-test scores, degree of learning was not a significant predictor of TABE post-test scores. The next chapter will explore these findings with connections to the literature. Limitations and recommendations for future research will also be discussed.

Chapter Five: Discussion

This study explored predictive factors for test readiness in adult basic education (ABE). The study's principal aim was to determine if a metric could predict test readiness sooner than the 40-hour guideline set by the test publisher. If so, an ABE program could determine the ideal post-testing time upon enrollment rather than rely on the standard recommendation based on instructional time. This chapter summarizes the study's findings and discusses its limitations and conclusions. It then presents these findings' implications for practice, theory, and research and suggests future research.

Summary of the Findings

The framework for this study, Model of School Learning (MSL), measures the degree to which a student learns using five factors: time spent in learning, the time needed to learn, perseverance, ability to understand instruction, and quality of instruction (Figure 8). This model was adapted to an ABE context and available ABE metrics in the current study. In addition, a non-experimental cross-sectional design was employed to explore the fiscal year 2019–2020 dataset from Arkansas ABE centers to show how instructional time and MSL account for variation in adults' post-test reading scores using this adapted model.

Figure 8

ABE Degree of Learning

$$\text{ABE Degree of Learning} = f\left[\frac{\text{Lifetime Hours} \times \text{Ratio of current fiscal year hours to lifetime hours}}{\text{Unfinished Carnegie Units} \times \left[\text{Effective \& Efficient} \times \text{Locator Level}\right]}\right]$$

The adapted model for this study is named the *ABE Degree of Learning* (ABEDL). The ABEDL included metrics and constructs that are available to ABE practitioners. For example, in the ABEDL model, the independent variables from MSL were exchanged and applied to calculate the degree of learning metric: (a) the time needed to complete compulsory education (unfinished Carnegie Units), (b) instruction quality (effective and efficient), (c) ability to understand instruction (locator level), (d) lifetime instructional hours, and (e) a ratio of time spent engaged in learning relative to time dedicated to learning. The dependent variable was the test of adult basic education (TABE) post-test score.

Non-support of Hypothesis

Results indicated that degree of learning did not predict TABE reading scores, thus supporting the null hypothesis:

> $H1_0$: Carroll's Model of School Learning does not account for additional variance in TABE 11 or 12 scores beyond instructional time after controlling for age.

Results also showed that the TABE pre-test score was a significant predictor of TABE post-test scores, $b = 0.60$, $t(94) = 8.00$, $p < .001$. A one-unit increase in TABE pre-test scores is associated with a 0.60 unit increase in TABE post-test scores. The implications are that ABE programs can predict that the higher the intake pre-test is, the higher the post-test will be.

Further analysis revealed a significant negative correlation between age and TABE post-test score ($r = -.21$, $p = .034$, 95% CI = [-.39, -.02]). This suggests that as age increases, TABE post-test scores decrease. The age-related finding partially supports Picconne's (2006) results, showing ABE participants ages 27-34 scored better than older age groups.

Additionally, a significant positive correlation was observed between locator level (the pre-assessment given upon enrollment to ABE to indicate the education functioning level upon

ABE enrollment) and TABE post-test scores, $r = 0.57$, $p = <.001$, 95% CI = [0.42, 0.69]. As the locator level increases by one unit, TABE post-test scores increase by 0.57 units. The results support Arkansas ABE policy to administer the locator for every adult learner upon enrollment before pre-testing.

Interpretation

As noted earlier, findings related to age and post-test TABE scores partially support previous research by Piccone (2006). The age groups used in Picconne's (2006) study were 27-34, 18-26, 35-41, and 42-71. Piccone (2006) found that those 27-34 years old had higher scores than those in the 42-71 age group. However, key differences between my study sample and Piccone's (2006) make it difficult to draw clear connections. First, Piccone measured students' TABE scores six months apart, whereas testing times varied in my study. Second, Picconne's sample was grouped by age, whereas my study treated age as a continuous variable. Third, Piccone's sample comprised incarcerated adults, whereas mine was not. However, both studies suggest that age should be considered in post-test decision-making.

This study also found that instructional time did not predict TABE post-test scores. Individual differences and instructional quality may have contributed to this finding. Carroll (1981) postulated that people possess traits that help them accomplish learning tasks at different rates. Carroll (1970) also believed that the interactive effect of instructional time depended on both the instruction quality and ability to understand instruction; the person receiving high-quality instruction will attend less instructional time than the person receiving inadequate quality instruction (Anderson, 1985). Carroll (1970) believed that time spent learning would be equal to the lesser of the three variables in his model: time allowed for learning, time willing to engage in learning activities, and time needed to learn (Anderson, 1985). The average quality of instruction

rating for the study sample was 48%, so half of the adult learners in all ABE programs represented in this study produced measurable skill gains in education functioning level. Many studies have assessed various individual differences in adult learners linked to instructional hours and learning (Bennett, 1978; Bloom, 1976; Bruner, 1966; Carroll, 1963; Cooley & Leinhart, 1975; Gagne, 1977; Glaser, 1976; Harnischfeger & Wiley, 1976). Although the findings of these studies differed, they illustrated those variables other than time affect learning and standardized test results. The results of my study further support this idea.

This study also found that TABE pre-test scores predicted TABE post-test scores. This finding aligns with an adult education policy that requires a minimum TABE pre-test score of 535 out of 800 before starting high school equivalency testing. In addition, reading comprehension skills learned before entering ABE improve participants' TABE pre-test skills (Tighe & Schatschneider, 2016). Tighe and Schatschneider (2016) identified several reading comprehension sub-components assessed in TABE (morphological awareness, language comprehension, fluency, real-word decoding, and working memory) in their ABE meta-analysis. Adult learners with proficiency in these reading skills demonstrated higher pre-test and post-test scores, illustrating a clear relationship between the two tests. My results support such findings.

This study also found that Degree of Learning (DL) did not predict TABE post-test scores. The DL is intended to assess any learning task, according to Carroll (1989). The TABE scale score represents learning gains for associated learning tasks. Venezky and colleagues (1994) warned of a problem with scale scores lacking an equal interval because score scales do not evenly reflect the vast amount of learning in respective grade level equivalencies. The TABE scale to which Venezky and colleagues (1994) referred showed a 3-point interval in two places on the scale with disparaging values (757-760 at 0.4-grade level and 771-774 at 1.4-grade

levels); thus, the same performance on the scale can result in different grade-equivalent changes. I believe the DL did not predict TABE post-test scores in my study due to the complexity of tasks associated with learning how to read and the unequal interval in the TABE 11 & 12 scale.

Relationships between MSL Measures

To better understand how the MSL model applied to my sample, I investigated relationships between the individual measures. I examined the first relationship between lifetime hours (*time allocated for learning*) and TABE reading post-test. I found no correlation between these two measures, $r = -0.14$, $p = .167$, 95% CI = [-0.33, 0.06]. Within my sample, instructional hours over the lifetime enrollment ranged from 17 to 1,823.25. TABE scores ranged from 404 to 597.

Instructional time is the basis of ABE program functions. Carroll (1989) believed that his MSL construct, time allocated for learning, influenced Benjamin Bloom's (1974) *Mastery Learning*. Carroll's MSL is a theoretical explanation of learning (Carroll, 1989). Carroll (1970) believed that time allocated for learning further interacted with the instruction quality and ability to understand instruction. Within the current study, the ability to understand instruction significantly predicted time allocated for learning, $b = -111.67$, $t(96) = -2.32$, $p = .022$. A one-unit increase in the ability to understand instruction decreases the value of time allocated for learning by 111.67 units. This finding supports Carroll's (1981) belief that the more the learner can understand instruction, the less the time needed to learn.

I examined the second relationship between unfinished Carnegie Units (*time needed to learn* or *aptitude*) and TABE post-test scores. No relationship was found, $r = -0.11$, $p = .287$, 95% CI = [-0.30, 0.09]. According to Carroll (1963), the time needed to learn varies for everyone, but given enough time, all are capable of academic achievement (Reeves, 1997).

Carroll (1963) referred to this variable as aptitude, and it was cited as the most influential variable (Bloom, 1977). Aptitude or time needed to learn was the most challenging construct to exchange with an ABE metric. Since Carroll (1989) viewed this construct as the total time needed to learn a task, reading skill development is too intricate to assess with a single metric derived from total instructional time missed after dropping out of school. Further research must exchange another metric with Unfinished Carnegie Units. A better exchange might be to apply the obtained points from the performance on domains accessible from the TABE Profile Report, *key ideas and details, craft and structure,* and *integration of knowledge and ideas* (Appendix A).

I examined the third relationship between effective and efficient (E & E) rating (quality of instruction) and TABE post-test scores. No relationships were found, $r = 0.02$, $p = .816$, 95% CI = [-0.17, 0.22]. The quality of instruction metric calculated for ABE programs is derived from the measurable skill gains and general education diplomas earned by each program's participants. Quality of instruction is a construct that Carroll (1989) described with the MSL as relational to the time needed to learn. Carroll (1989) admitted that MSL "is not specific about the characteristics of high-quality instruction, but it mentions that learners must be told what they are to learn, that they must be put into adequate contact with learning materials and that steps in learning must be carefully planned and ordered (p. 26)." The usage of E & E in ABE and therefore applied to MSL does not precisely align with Carroll's (1989) explanation of high-quality instruction. Future researchers can apply E & E to one of the sub-domains of TABE, key ideas, details or craft, and structure, or integration of knowledge and ideas since the learning materials in ABE align with the TABE sub-domains assessed. ABE programs are held to an E & E benchmark, and that numerical rating is derived from a combination of all teachers' (instructors) instructional gains derived from all participants' learning for the fiscal year in ABE.

The MSL is specific to learning quality. Therefore, E & E's future usage in the ABE model is questionable, especially for programs that do not calculate individual teachers' (instructors) E & E. The TABE reading score in this dataset was measured against a collection of teachers (instructor) abilities. Perhaps replacing an individual teacher's (instructor) E & E with the E & E for an entire program will illustrate this relationship.

I examined the fourth relationship between current fiscal year instruction hours to lifetime instructional hours (Carroll's *perseverance*) and TABE post-test scores. No relationship was found, $r = -0.09$, $p = .368$, 95% CI = [-0.28, 0.11]. In Carroll's (1963) MSL, this variable is derived from the time spent learning divided by the time needed to learn. The time needed to learn is unique to each learner (Carroll, 1989). Carroll (1970) viewed this construct as the lesser of the three time-bound measurements within his MSL and specified that perseverance operationally defined motivation for learning. The range of the ABE perseverance ratio in this study was 0.002–0.79. A disproportionate number of participants had less than 50% perseverance rates, $N = 94$. There was no relationship between perseverance and TABE reading post-test scores in a study sample containing most adults with difficulty reading.

I examined the fifth relationship between the locator level (*ability to understand* instruction) and instruction quality metrics. No relationship was found, $r = 0.04$, $p = .703$, 95% CI = [-0.16, 0.23]. My interpretation of the ability to understand instruction supported Anderson's (2014) supposition that the better the instruction quality, the less the locator placement needed to be for learning. For this study, an ABE participant who took a locator and scored a level D would need less instructional time than a comparative ABE participant who scored on a locator level E. The instruction quality range was .32–.56, meaning that the sample received instruction from ABE programs with a record of accomplishment of MSG from 32% to

56%. A majority of the sample located at a struggling reader's locator level, $n = 68$, and most of the ABE programs, $n = 52$, did not have a history of greater than 51% of adult learners achieving an MSG. When both factors are considered, the likelihood of locator level and instruction quality having a significant relationship is unlikely. Further analysis of the ability to understand instruction (locator) and instruction quality was conducted. Findings showed that instruction quality did not predict TABE reading post-test score, $b = 0.59$, $t(95) = 0.01$, $p > .05$. The ability to understand instruction (locator) predicted the TABE reading post-test score, $b = 26.79$, $t(95) = 6.56$, $p < .001$, indicating that a one-unit increase in the ability to understand instruction (locator) will increase the TABE reading value post-test score by 26.79 units. These findings support the customary practice in ABE to pre-determine prescriptive instructional plans based on locator level upon enrollment. The ABE program planning should consider the locator level and TABE pre-test score for predicting the TABE post-test score.

I examined the sixth relationship between locator level (ability to understand instruction) and unfinished Carnegie Units (time needed to learn). No relationship was found, $r = 0.05$, $p = .617$, 95% CI = [-0.15, 0.25]. In Anderson's (1985) MSL outline, learners' understanding of instruction interacts with their aptitude to determine their learning time. The previously discussed locator range reveals that most of the study sample were ABE, yet the last grade level completed for $N = 86$ was secondary education. The implication of this is reflective of the on-grade-level literacy of the regional population. If the study participant entered ABE with a reading ability less than secondary education level, then evidence supports that learner progress beyond primary education did not occur. As a result of this finding, further analysis was conducted to determine whether unfinished Carnegie Units (time needed to learn) would predict TABE reading post-test scores. No relationship was found, $b = -0.02$, $t(96) = -1.66$, $p > .05$.

Consequently, future research must determine a variable to exchange in the ABEDL model to represent the last grade level completed.

I examined the last relationship between locator level (*ability to understand instruction*) and TABE post-test scores. A positive relationship was found, $r = 0.57$, $p = <.001$, 95% CI = [0.42, 0.69]. Carroll (1963) defined the ability to understand instruction as general intelligence. For my study, this construct was exchanged for the locator level of the study sample participants because the locator is used to determine rigor for assessing new ABE enrollment, like Carroll's (1963) definition of the construct. The locator is administered before the TABE pre-test so that a rigor level can be selected, e.g., level e, m, d, a, or easy, medium, difficult, or advanced. I chose to use this variable in exchange for the ability to understand instruction based on the current ABE practice, along with the DRC's TABE 11 & 12 assessment construct validity (DRC, 2017).

Implications for Practice

ABE practitioners can rely on the TABE pre-test to determine post-test predictability. This study's results support the current practice of setting a required TABE score before high school equivalency testing begins. Since TABE 11 & 12's inception in Arkansas, the required score for qualifying to take the high school equivalency test changed from 563 (eighth grade, ninth month) to 535 (fifth grade, ninth month). I recommend policymakers consider further decreasing the TABE score for qualifying to take the high school equivalency.

Given these points, a comprehensive analysis was conducted analyzing the covariance of constructs and metrics on TABE reading post-test scores and the relationship among the model's variables. The research results address a literature gap by analyzing Carroll's MSL in ABE since few studies were found that paired MSL with ABE. The constructs, variables, and metrics used to interpret MSL links to accessible ABE data can be further researched. However, because of

the significance of the TABE Reading pre-test to Reading post-test predictability, one can assume that further exploration into other TABE subjects, e.g., math and language, may reveal a different connection between the independent and dependent variables analyzed in my study.

Implications for Practice: TABE 11 & 12 Locator

A frequent practice in ABE is to pre-plan instruction or predict an adult learner's reading capabilities through the DRC's locator. Adult learners with reading comprehension difficulties (levels 1, 2, and 3) are present in ABE programs, and, as presented in chapter one, I noticed in my ABE programs that students completed many enrollment hours before learning progress occurred (2017-18: 153.75 hours, 2018-19: 194 hours, 2019-20: 154.75 hours, 2020-21: 203.50 hours, 2021-2022: 222 hours). Recall that level 1, 2, and 3 learner reading comprehension is comparable to elementary school grade levels K–5. It should be noted that levels 1, 2, and 3 learners comprised most of my study population (n = 77, 80.80%). Researchers in the last four decades cited language comprehension and word recognition as having significant effects on reading comprehension (Bristow, 1987; Scarborough, 2001). The variance between study participants located at the easy and medium levels and demonstrated reading comprehension difficulties (Easy & Medium, 68.69%) and then pre-tested outside the individual NRS level was small (n = 9). This lack of variance supports pre-planning with the locator results.

Implications for Practice: TABE 11 & 12 Word Count

ABE administrators and instructors must know that the TABE 11 & 12 reading assessment scale structure contains mathematical advantages that may skew the overall ABE program benchmarks. The mathematical advantages I am referring to are implications for practice found while researching this study are worth noting. For example, my study sample's pre-test scores ranged from 369–597, which included 19 participants that later post-tested out of

ABE and into adult secondary education (ASE). Additionally, adult learner participants will have an increased likelihood of scoring better between versions if the ABE program tests with version 11 before version 12 based on the idea that the number of words in a reading passage impacts the reading's difficulty. Due to word count differences between test versions, an ABE participant does not have to improve reading speed to improve their chance of completing TABE because the word count changes between TABE 11 and TABE 12 (Table 13).

Table 11*: TABE 11 & 12 Average Word Count (DRC, 2017)*

Level	Form	Average Word Count
E	Form 11	422
E	Form 12	301
M	Form 11	485
M	Form 12	463
D	Form 11	562
D	Form 12	497
A	Form 11	676
A	Form 12	596

The decreased word count from version 11 to version 12 may influence pre-test to post-test scale score gains. Appendix D: *TABE Level M Reading Score Guide* provides raw score conversions for each TABE test. For example, a test taker with a raw score of 24 on TABE 11 would score an NRS Level 2 score (493), and the same raw score (24) for the post-test on TABE 12 would produce an NRS Level 3 score (501). The same accuracy level results in a grade-level equivalency threshold difference of two grade levels (third grade, ninth month in TABE 11 and fifth grade, ninth month in TABE 12 for the same raw score). The scale score and a decreased word count from 485 to 463 may skew the pre-test-post-test score when paired together. The scale score variation between TABE 11 and 12 would require someone to achieve less raw score accuracy to increase their NRS placement, thus earning a measurable skill gain (MSG) for the

ABE program that administered the test when an improvement in reading ability scoring did not occur. The implication is that data sets using TABE scale scores may be skewed; with this in mind, a raw score analysis would fit a future ABE research study model.

An additional discovery made during my research that affects ABE practice is shown in Appendix E: *TABE Level D Reading Score Guide.* The scale score for the ASE level 5 starts from a raw score of 36 in TABE 11. Uniquely, the same raw score (36) in TABE 12 will report an adult learner as an ABE level 4. The pattern described previously reappears in Appendix F: *TABE Level A Reading Score Guide,* whereas a raw score of 41 is an NRS Level 5 in TABE 11, resulting in an NRS Level 6 in TABE 12. Given that, we can learn that raw score results need to be referenced in addition to the scale score to identify reading ability improvements between pre-test and post-test accurately.

Implication for Practice: TABE 11 & 12 Classification Consistency

The DRC took steps to assess classification consistency for TABE 11 & 12 (DRC, 2017). Because achievement growth is the basis of MSG attainment for ABE programs, DRC calibrated both versions using a subset of adult learners (n = 300) using single group repeated measures with counterbalancing to compare performance across both forms (DRC, 2017). The percentage of repeat DRC test-takers locating NRS level attainment for a locator Level E Reading was lowest for EFL levels 3 and 4. The locator Level E assessment design was intended for EFL Levels 1 and 2, so DRC reports intentionality in test design through "explicit test targeting" (DRC, pg. 82, 2017). My study implies that the identified level of rigor resulting from the locator results is supportive of the TABE test designer. Provided that approximately 39% of my study's participants (n = 39) enrolled at EFL Level 1 and 2, and with DRC's range of 70–79% test placement accuracy, I have confidence in the pre-test-post-test results in my study. Any doubt is

evident in EFL Level 3, where 56% of calibrators tested above or below EFL level during retesting. My study participants included 41% placed at EFL Level 3 (*n*=41) (Table 14).

Table 12

TABE Reading Level E: Percentage of Correct, False Positive, and False Negative Classification in Pre-Test to Post-Test Administration of TABE 11 & 12 Reading (DRC, 2017)

Educational Functioning Level (EFL)	*N*	NRS Level Matched Between Assessments	NRS Level Higher Between Assessments	NRS Level Lower Between Assessments	Items Located at Each Level on TABE 11 & 12
1	70	70	30	0	7
2	149	79	10	11	28
3	41	44	15	41	2
4	18	50	44	6	2

In contrast, the locator level of the study sample reveals that ABE programs in my study sample may have missed potential TABE MSG. The locator Level M assessment in ABE is expected to be an EFL Level 3 placement based on my experience. Therefore, the Level M accuracy is 45% for DRC testers retested above or below EFL Level 3. Since ABE instruction is planned from the locator level and TABE pre-test score, the statewide sample population might have missed MSG gains because instruction was not aligned with the instructional skill level for 45% of 41 people (*n*=18) (Table 15).

Table 13

TABE Reading Level M: Percentage of Correct, False Positive, and False Negative Classification in Pre-Test to Post-Test Administration of TABE 11 & 12 Reading (DRC, 2017)

Educational Functioning Level	N	NRS Level Matched Between Assessments	NRS Level Higher Between Assessments	NRS Level Lower Between Assessments	Items Located at Each Level on TABE 11 & 12
1	15	60	40	0	2
2	155	81	14	6	22
3	63	56	10	35	7
4	65	48	28	25	5
5	29	38	10	52	3

It is important to realize that the same analysis for locator Level E is used to analyze locator Level D. Level-D's accuracy is concentrated at EFL level 5, where 60% of DRC's testers tested below or above NRS level 5 from pre-test to post-test. Experience leads me to confirm that Level D assessments are reliable for EFL Level 4 adult learner participants. My study was conducted on 18 Level D adult learners. DRC recommends that less than 50% of their test-takers placing below or above the identified locator level is acceptable and that 100% accuracy is not possible, as stated in the TABE validation study (DRC, 2017). The Level D calibration was at 39% for EFL Level 4 adult learners, furthering the reliability of TABE 11 & 12 pre-tests to post-test statistical significance for EFL Level 4 adult learner participants.

Implications for Theory

My research furthers the applicability of Carroll's (1963) MSL. Carroll (1963) grouped the MSL variables as influences on the amount of time the learner must spend on learning (Anderson, 1985). Two of the five constructs of Carroll's MSL (1963) were time-based, and Carroll postulated that the main influence on the time needed to learn is the learner's aptitude (unfinished Carnegie Units applied for this metric in my study) (Anderson, 1985). Several studies linked instructional time and learning (Carver, 1970; Carroll & White, 1973: Cook,

Levinson, & Garside, 2010; Cooper & Pantle, 1967; Crai & Tulving, 1975; Gettinger, 1984; Meehan & McCallig, 2018; Piccone, 2006; Reed, 2015; Sjorgen, 1967; Venezky et al., 1994). My analysis also supports Ziegler and Ebert's (1999) meta-analysis of 28 ABE assessment studies, focusing on providing ABE researchers and policymakers with information about the length of time to earn a diploma. Like my study results, Ziegler and Ebert (1999) found that ABE completion is influenced by more than the rate of time the TABE test is given.

The results further Carroll's (1963) view that correlational and factor analysis must be the basis for researching individual differences in the time needed to learn studies (Anderson, 1985). The skills necessary to read proficiently are complex. When Carroll (1981) discussed complex learning tasks, he believed that learning one response may be a prerequisite for learning the other, e.g., learning letters before blending two or more letters. Carroll (1981) added that the transfer of a learning task may be required to learn the other and that both tasks could have been learned together (Anderson, 1985). If ABE theory is to develop, it will require a deeper analysis of individual persons in a research study. The depth necessary should be isolated to the individual level of intelligence.

One implication is that this study may impact the direction of qualitative ABE research. Current ABE research, including Pickard's (2021) ethnographically grounded qualitative study, delved into measurable outcomes' influence on ABE instruction for adults with difficulty reading. The perceived need to identify an efficient method of identifying post-test readiness so adult learners can achieve their learning goals rapidly influenced my research. Reflecting on my start in ABE, it is likely that the accountability pressures for ABE motivated me to look for the quickest way to achieve an MSG, especially since the performance benchmarks are based on adult learner progress made in the 90-days up to a timeframe that fit neatly into a fiscal year.

Pickard (2021) found that meaningful engagement was missed in a rush to achieve the next TABE gain. My study sample showed significance for pre-test to post-test prediction. The theoretical viewpoint that my study's results may change harkens back to Carroll's (1963) original work; the degree of learning is a function of time spent learning divided by the time needed to learn. The fiscal year is not enough time for an ABE participant to progress and marginalizes struggling readers between those who can finish in less than 40 hours and those who cannot.

Implications for Research

I recommend that future researchers use different model constructs derived from ancillary and other ABE sources such as raw score data, nominal categories for last grade level completed, and links between TABE pre-test to TABE post-test to general educational development scoring. Since this research began in 2019, more accessible measures of *time on task* have been available through online learning management systems. In particular, the Aztec Learning Management System® provides time on task and instructional time to ABE programs that use the distance learning online management system. The time on task is calculated by measuring the time the adult learner is actively engaged in the learning management system's content. Future researchers may want to calculate a ratio from time on task to instructional hours for the construct, the percentage of time spent learning. The construct I derived for perseverance was a ratio of current fiscal year hours to lifetime instructional hours and resulted in a small strength of association, $r(97) = -.09$, $p = .368$. The ratio of time used in this study did not consider the attendance transiency that occurred throughout the adult learner's attendance history because data on the number of times an adult learner enrolled, left the program, and returned were not accessible. Adult learner transiency can be gleaned from the period of participation that an ABE

participant has listed in their database profile. Future researchers may consider using a three-part calculation that applies the number of periods of participation to the ratio of hours. By following this recommendation, future researchers will be able to calculate a robust ratio of perseverance. Learner transiency is an important consideration because the length of time required for struggling readers to improve their reading ability does not always fall into the framework of a fiscal year.

Another recommendation for future research is changing the ability source to comprehend instruction construct (locator). Despite the large effect size of the locator on the TABE post-test score, an intelligence assessment instrument is recommended for future studies. An assessment will calculate general intelligence, like the Wechsler Adult Intelligence Scale (WAIS®). The WAIS® assesses four areas (perceptual reasoning, processing speed, verbal comprehension, and working memory) to determine two scores: (a) full-scale intelligent quotient (IW) and (b) a general ability index (Susman, 2020). The latest version, WAIS-IV®, is based on Carroll's *fluid reasoning* (1997), Beehner and colleague's *working memory* (2006), and Finkel and colleague's age-related *processing speed* (2007) (Hartman, 2009). It is important to realize that the psychometric principles posited by the influential researcher theories analyzed in WAIS-IV will allow for a shift from my study direction to a science of learning. The WAIS-IV produces a numerical score that fits into an altered formula model for future research. A brief version for assessing intelligence can be found using the Wechsler Test of Adult Reading. Using an alternate metric of intelligence is important for replacing the ability to understand instruction with an instrument that is not within the DRC TABE testing battery.

Further research can pinpoint a more accurate understanding of instruction rating from the WAIS. Additionally, the results' accuracy may lead future researchers to isolate a post-test

readiness predictor in ABE. This recommendation is based on the limitation of the locator level being calculated from a range of values from 0 to 19; thus, the scaled WAIS-IV range is broader than the locator range calculated for this study (1–5). However, due to the WAIS-IQ scale's breadth and a standard deviation within the scale, I believe that the assessment will yield a more accurate value for a test subject's ability to comprehend instruction.

My final recommendation for future research is to utilize the TABE 11 & 12 assessments' instructional sub-domains for the dependent variable. My study used a scale score calculated from the accuracy score of a combination of correct answers on each of the sub-domains of the TABE. A future study could use the MSL DL as the independent variable and each of the obtained correct answer raw scores as the dependent variable, e.g., key ideas and details, craft and structure, and integration of knowledge and ideas. All reading sub-domains list the obtained number of points out of a total raw score, so a future researcher can extract the data from another sample ABE population to analyze reading or another TABE subject convergently.

Generalizability

This research study's strength is the narrowing of the ABE literature gap. This study addressed one research question, "Does Carroll's Model of School Learning account for additional variance in TABE 11 & 12 scores beyond instructional time after controlling for age?" The answer to this question was no. Since the locator assessment and the TABE pre-test score had relationships with the TABE reading post-test scores, a non-time-based consideration for qualifying TABE 11 & 12 scores to take the high school equivalency assessment should be considered. Further, my recommendation to policymakers is to revise the current ABE programs' post-test policy to remove instructional time for determining post-test readiness because no correlation was found that linked instructional time to TABE post-test score. Therefore,

instructional time should not determine post-test readiness; instead, a TABE locator score, TABE pre-test score, and age should determine post-test readiness. DRC only enforced the instructional time required to prevent a practice effect from occurring due to repeated exposure to TABE 11 & 12, and is detrimental to the adult learners' ABE progress; thus, it is the reason for adult learner attrition.

Summary

Adults who seek to finish their secondary education look to ABE programs as gateways to vocational and post-secondary education. Identifying a model to determine post-test readiness for adults re-enrolling into ABE programs must be found. Although adult learner attrition, which occurs after 90-days of absenteeism in ABE (*separation*), is a problem in ABE programs, ABE practitioners' instructional planning for returning enrollment should differ from the instructional plan for new enrollment. The case can be made that the participants' past instructional exposure and resulting learning would positively affect future reading ability; therefore, at a minimum, the re-enrollment practice of readministering the TABE locator and TABE pre-test should be a standard operating procedure. In theory, educators can use student enrollment testing data to calculate whether adults are ready to post-test. However, they have yet to determine what data best predict post-test readiness because of the preventive nature of time-based assessment practice. As an illustration, a new enrollee with no ABE history is ideal for using the TABE pre-test score as the only post-test readiness factor until either (a) the adult learner separates from the ABE program or (b) graduates. If the participant separates from the program and later returns, the program can use a readiness model found later in future studies.

To summarize, this study used hierarchical linear regression to analyze the variance accounted for by Carroll's (1963) Model of School Learning, Degree of Leaning, on TABE 11 &

12 scores beyond instructional time after controlling for age. Further investigation was conducted on the relationship between the five constructs of Carroll's model and TABE 11 & 12 post-test scores. Results indicated that the degree of learning does not predict TABE post-test scores. Still, TABE pre-test scores did predict TABE post-test scores. Additionally, the adult learner's locator level (ability to comprehend instruction) significantly predicted TABE post-test scores. Although the null hypothesis was accepted as the study result, ABE data availability leaves an opening for further research. Future research should analyze other constructs to identify better fitting data to account for additional variance in TABE 11 & 12 scores. The 44 state ABE programs that use TABE 11 & 12 can benefit from exploring other data constructs to identify an ABE degree of learning to determine the optimal TABE post-test time. All ABE programs should use the DRC assessment results from the locator and pre-test to determine post-test readiness, although conscientious efforts should be made to avoid the practice effect due to assessment overexposure.

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Appendices

Tables

Table 14: Reading Level L, Reading Foundation Skills (DRC, 2017)

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
	7	1	1
	8	2	1
Partial Proficient	9	2	2
	10	2	2
	11	2	2
	12	2	2
	13	2	2
	14	3	2
Proficient	15	3	3
	16	3	3
	17	3	3
	18	3	3

Note: The correct raw score determines the level of proficiency, e.g., nine correct on TABE 11 or 12 is partial proficient.

Table 15*: Reading Level L: Key Ideas and Details (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	2	2
	6	2	2
	7	2	2
Partial Proficient	8	2	2
	9	2	3
Proficient	10	3	3
	11	3	3

Note: The correct raw score determines the level of proficiency, e.g., eight out of eleven correct on Form 11 or 12 is partial proficient.

Table 16*: Reading Level L: Craft and Structure (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
Partial Proficient	1	2	2
	2	2	2
	3	2	2
Proficient	4	3	3

Note: The correct raw score determines the level of proficiency, e.g., one correct on Form 11 or 12 is partial proficient.

Table 17*: Reading Level L: Integration of Knowledge and Ideas (DRC, 2017)*

Sub-categorical Rating	Raw Score	Form 11 Performance Level	Form 12 Performance
Non-proficient	0	1	1
	1	2	1
Partial Proficient	2	2	2
	3	2	2
	4	2	2
Proficient	5	3	2
	6	-	3

Note: The correct raw score determines the level of proficiency, e.g., nine correct on Form 11 or 12 is partial proficient.

Table 18: *Reading Level E: Reading Foundational Skills (DRC, 2017)*

Sub-categorical Rating	Raw Score	Form 11 Performance Level	Form 12 Performance
Non-proficient	0	1	1
	1	2	1
Partial Proficient	2	2	2
	3	2	2
	4	2	2
Proficient	5	3	2
	6	-	3

Note: TABE level E (cf. Table 6-9) assesses all the areas the lower assessment (L) does but lacks phonological awareness. The primary focus on level L is reading informational texts. From the assessed reading passages, the test taker will be asked to determine the main idea, identify relationships with the text, identify the author's purpose, point of view, text features, illustrations, and reasons Perrin, 2019).

Table 19: *Reading Level E: Key Ideas and Details (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
	7	1	1
Partial Proficient	8	2	2
	9	2	2
	10	2	2
	11	2	2
Proficient	12	2	3
	13	2	3
	14	3	3
	15	3	3
	16	3	3

Table 20: *Reading Level E: Craft and Structure (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
Partial Proficient	7	2	1
	8	2	2
	9	2	2
	10	2	2
	11	2	2
Proficient	12	3	2
	13	3	3
	14	3	3

Table 21: *Reading Level E: Integration of Knowledge and Ideas (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	2
Partial Proficient	4	2	2
	5	2	2
	6	2	2
	7	2	3
Proficient	8	3	3
	9	3	-

Table 22: *Reading Level M: Key Ideas and Details (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
	7	1	1
	8	1	1
	9	1	1
	10	1	2
Partial Proficient	11	2	2
	12	2	2
	13	2	2
	14	2	2
	15	2	2
Proficient	16	3	2
	17	3	3
	18	3	3
	19	-	3
	20	-	3

Note: TABE Reading Level M builds on what areas are assessed in level E but removes word recognition and phonics (cf. Table 5). The assessed reading skills build on the prior topics with level-appropriate texts and increasing depth, expanding to include literary texts, evidence, and structural elements (Perrin, 2019).

Table 23: *Reading Level M: Craft and Structure (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
	7	1	1
	8	1	1
	9	1	1
	10	1	2
Partial Proficient	11	2	2
	12	2	2
	13	2	2
	14	2	2
	15	2	2
Proficient	16	3	2
	17	3	3
	18	3	3
	19	3	3
	20	3	-

Note: The correct raw score determines the level of proficiency, e.g., eleven correct on Form 11 or 12 is partial proficient

Table 24: *Reading Level M: Integration of Knowledge and Ideas (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	2
	3	2	2
Partial Proficient	4	2	2
	5	2	2
	6	2	2
Proficient	7	3	3
	8	3	3
	9	3	-

Note: The correct raw score determines the level of proficiency, e.g., three correct on Form 11 or 12 is partial proficient.

Table 25*: Reading Level M: Key Ideas and Details (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
	7	1	1
	8	1	1
	9	1	1
	10	1	2
Partial Proficient	11	2	2
	12	2	2
	13	2	2
	14	2	2
	15	2	2
Proficient	16	3	2
	17	3	3
	18	3	3
	19	-	3
	20	-	3

Note: The correct raw score determines the level of proficiency, e.g., nine correct on Form 11 or 12 is partial proficient.

Table 26*: Reading Level D: Key Ideas and Details (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
	7	1	1
	8	1	1
	9	1	1
	10	1	1
	11	1	1
Partial Proficient	12	2	2
	13	2	2
	14	2	2
	15	2	2
Proficient	16	3	2
	17	3	3
	18	2	3
	19	3	3
	20	3	3
	21	3	-
	22	3	-
	23	3	-

Note: This level transcends the test taker in greater integration of ideas (cf. Table 14-16). Other areas of the assessed subtopics mirror the previous level but the percentage of emphasis between craft and structure (decrease 4%) and integration of knowledge and ideas (an increase of 4%). In addition, reading skills build on the prior topics with level-appropriate texts and increasing depth, adding social studies and science/technology texts (Perrin, 2019).

Table 27*: Reading Level D: Craft and Structure (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
	7	1	1
	8	1	1
Partial Proficient	9	2	1
	10	2	1
	11	2	2
	12	2	2
	13	2	2
	14	2	2
	15	3	2
Proficient	16	3	2
	17	3	3
	18	3	3
	19	-	3

Note: The correct raw score determines the level of proficiency, e.g., eleven correct on Form 11 or 12 is partial proficient.

Table 28*: Reading Level D: Integration of Knowledge and Ideas (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
Partial Proficient	4	1	1
	5	2	2
	6	2	2
	7	2	2
Proficient	8	2	2
	9	3	2
	10	3	3
	11	-	3

Note: The correct raw score determines the level of proficiency, e.g., five correct on Form 11 or 12 is partial proficient.

Table 29*: Reading Level A: Key Ideas and Details (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
	7	1	1
	8	1	1
	9	1	1
	10	1	1
	11	1	1
	12	1	1
	13	1	1
	14	2	1
Partial Proficient	15	2	2
	16	2	2
	17	2	2
	18	2	2
	19	2	2
	20	2	2
Proficient	21	3	2
	22	3	2
	23	3	3
	24	-	3
	25	-	3
	26	-	3

Note: Level A assesses the same percentage of reading subcomponents as the level E-assessment (cf. Table 17-19). Noteworthy differences for this assessment level are reading skills building on prior topics with level-appropriate texts and increasing depth, expanding significantly on persuasive ideas: rhetoric, comparing points of view, and claims/arguments/ reasoning (Perrin, 2019).

Table 30*: Reading Level A: Craft and Structure (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
	4	1	1
	5	1	1
	6	1	1
	7	1	1
	8	1	1
	9	1	1
	10	1	1
	11	1	1
	12	1	1
	13	1	2
	14	2	1
Partial Proficient	15	2	2
	16	2	2
	17	2	2
	18	2	2
	19	2	2
	20	2	3
Proficient	21	3	3
	22	3	3
	23	3	3

Note: The correct raw score determines the level of proficiency, e.g., fifteen correct on Form 11 or 12 is partial proficient.

Table 31: *Reading Level A: Integration of Knowledge and Ideas (DRC, 2017)*

		Form 11	Form 12
Sub-categorical Rating	Raw Score	Performance Level	Performance
Non-proficient	0	1	1
	1	1	1
	2	1	1
	3	1	1
Partial Proficient	4	2	2
	5	2	2
	6	2	2
	7	2	3
Proficient	8	2	-
	9	2	-
	10	3	-

Note: The correct raw score determines the level of proficiency, e.g., four correct on Form 11 or 12 is partial proficient.

Table 32: *Descriptive Statistics for TABE 11 & 12 (DRC, 2017)*

Form	Test	Number of Items	Mean	SD	SEM	Reliability
Reading	L - 11	40	22.49	7.40	2.85	0.85
	L - 12	40	23.11	7.24	2.87	0.84
	E - 11	40	23.77	9.35	2.92	0.90
	E - 12	40	23.24	9.10	2.93	0.90
	M – 11	40	25.74	9.70	3.11	0.90
	M – 12	40	24.98	9.48	3.13	0.89
	D – 11	40	24.52	8.71	3.40	0.85
	D – 12	39	23.64	9.73	3.36	0.88
	A -11	40	24.77	11.43	3.59	0.90
	A - 12	40	25.54	10.39	3.72	0.87

Table 33: *TABE 11 & 12 Reading Mean Score (DRC, 2017)*

Scale Score mean: 539.09
Standard Deviation: 53.04

Table 34: *TABE IRT-Based Reliability Estimates, Online (DRC, 2017)*

Subtest	Level	Form 11	Form 12
Reading	E	0.90	0.89
	M	0.89	0.89
	D	0.84	0.88
	A	0.89	0.86

Table 35: *Locator Test Qualification (DRC, 2017))*

Number of Points Obtained	TABE Level Reading
0 – 5	Level E
6 - 11	Level M
12 – 15	Level D
16 - 19	Level A

Appendix A: IRB Outcome

UNIVERSITY OF ARKANSAS

To:	John W. Kelly
From:	Justin R Chimka, Chair IRB Expedited Review
Date:	10/14/2021
Action:	**Exemption Granted**
Action Date:	10/14/2021
Protocol #:	2105332201
Study Title:	Analyzing Carrolls Model of School Learning, Degree of Learning, in Adult Basic Education

The above-referenced protocol has been determined to be exempt.

If you wish to make any modifications in the approved protocol that may affect the level of risk to your participants, you must seek approval prior to implementing those changes. All modifications must provide sufficient detail to assess the impact of the change.

If you have any questions or need any assistance from the IRB, please contact the IRB Coordinator at 109 MLKG Building, 5-2208, or irb@uark.edu.

cc: Kevin M Roessger, Investigator
Kenda S Grover, Investigator

Appendix B: Sample TABE Reading Level M Profile Report (DRC, 2017)

Report Criteria	
ID:	State:
Test Name: TABE 11 ALL	District: SE ARKANSAS ED SERVICE CO-OP
Report: ALL	School: ARKANSAS NORTHEASTERN COLLEGE
Report Date: 05-01-2019	

Test Results	Test Date	Level	Number of Points		Items Attempted	Scale Score	SEM	NRS Level
			Total	Obtained				
Reading	03/15/2019	M	47	12	40	447	13	2
Mathematics	---	---	---	---	---	---	---	---
Language	---	---	---	---	---	---	---	---

--- Subtest Not Taken

If a student scores more than one NRS level above the targeted level, then a (+) sign will appear next to the scale score and their score will be set to the highest possible scale score, which is one above the targeted level. In this case, students may want to test with a higher TABE test in order to better assess their ability.

Scale scores with a minus (-) sign next to them are indicators that the student performed at the lower end of the performance range of that level of TABE and the student will likely need to have extended instruction to be ready to demonstrate an NRS Gain on a post test.

Performance on Domains	Number of Items	Number of Points		Performance Category		
		Total	Obtained	Non-Proficiency	Partial Proficiency	Proficiency
Reading						
Key Ideas and Details	18	18	7	✓		
Craft and Structure	17	20	5	✓		
Integration of Knowledge and Ideas	5	9	0	✓		
Mathematics	---	---	---	---	---	---
Language	---	---	---	---	---	---

Appendix C: TABE Reading L Score Guide (DRC, 2017)

	Form 11			Form 12		
Raw Score	Scale Score	SEM	NRS Level	Scale Score	SEM	NRS Level
0	300	33	1	300	33	1
1	300	33	1	300	33	1
2	300	33	1	300	33	1
3	300	33	1	300	33	1
4	304	32	1	300	33	1
5	320	27	1	306	31	1
6	332	24	1	320	27	1
7	342	21	1	332	25	1
8	350	20	1	342	23	1
9	358	18	1	351	21	1
10	365	17	1	359	20	1
11	371	16	1	366	19	1
12	377	16	1	373	18	1
13	382	15	1	379	17	1
14	387	15	1	385	16	1
15	392	14	1	390	16	1
16	397	14	1	395	15	1
17	402	14	1	401	15	1
18	406	14	1	406	15	1
19	411	14	1	411	15	1
20	416	14	1	415	15	1
21	420	14	1	420	15	1
22	425	14	1	425	15	1
23	430	14	1	431	16	1
24	435	15	1	436	16	1
25	440	15	1	441	16	1
26	445	16	2	447	17	2
27	451	16	2	453	17	2
28	457	17	2	459	18	2
29	463	18	2	466	19	2
30	471	20	2	473	19	2
31	479	21	2	480	20	2
32	488	23	2	489	22	2
33	498	25	2	498	23	2
34	500+	28	2	500+	26	2

	Form 11			Form 12		
Raw Score	Scale Score	SEM	NRS Level	Scale Score	SEM	NRS Level
35	500+	33	2	500+	29	2
36	500+	38	2	500+	33	2
37	500+	46	2	500+	40	2
38	500+	58	2	500+	53	2
39	500+	58	2	500+	57	2
40	500+	58	2	500+	57	2

Appendix D: TABE Level E Reading Score Guide (DRC, 2017)

	Form 11			Form 12		
Raw Score	Scale Score	SEM	NRS Level	Scale Score	SEM	NRS Level
0	310	48	1	310	56	1
1	310	48	1	310	56	1
2	331	37	1	319	50	1
3	353	28	1	349	35	1
4	368	24	1	368	28	1
5	379	21	1	381	24	1
6	389	19	1	392	20	1
7	396	17	1	400	18	1
8	403	16	1	407	17	1
9	409	15	1	414	15	1
10	415	15	1	419	14	1
11	420	14	1	424	13	1
12	425	14	1	429	13	1
13	430	13	1	433	12	1
14	434	13	1	438	12	1
15	438	13	1	441	12	1
16	442	12	2	445	11	2
17	446	12	2	449	11	2
18	450	12	2	453	11	2
19	454	12	2	456	11	2
20	458	12	2	460	11	2
21	462	12	2	463	11	2
22	466	12	2	467	12	2
23	470	12	2	471	12	2
24	474	12	2	475	12	2
25	478	13	2	478	12	2
26	482	13	2	482	12	2
27	486	13	2	487	13	2
28	491	14	2	491	13	2
29	496	14	2	496	14	2
30	501	15	3	501	15	3
31	506	16	3	506	15	3

	Form 11			Form 12		
Raw Score	Scale Score	SEM	NRS Level	Scale Score	SEM	NRS Level
32	512	16	3	512	16	3
33	518	17	3	518	17	3
34	525	18	3	525	18	3
35	533	20	3	533	20	3
36	535+	21	3	535+	22	3
37	535+	23	3	535+	24	3
38	535+	26	3	535+	27	3
39	535+	29	3	535+	31	3
40	535+	34	3	535+	37	3
41	535+	40	3	535+	45	3
42	535+	51	3	535+	60	3
43	535+	65	3	535+	70	3
44	535+	65	3	535+	70	3

Appendix E: TABE 11 & 12 Level M Reading Score Guide (DRC, 2017)

	Form 11			Form 12		
Raw Score	Scale Score	SEM	NRS Level	Scale Score	SEM	NRS Level
0	N/A	N/A	O/R	N/A	N/A	O/R
1	N/A	N/A	O/R	N/A	N/A	O/R
2	N/A	N/A	O/R	N/A	N/A	O/R
3	N/A	N/A	O/R	N/A	N/A	O/R
4	N/A	N/A	O/R	N/A	N/A	O/R
5	N/A	N/A	O/R	N/A	N/A	O/R
6	N/A	N/A	O/R	N/A	N/A	O/R
7	N/A	N/A	O/R	N/A	N/A	O/R
8	442-	14	2	442-	15	2
9	442-	14	2	442-	15	2
10	442-	14	2	442	15	2
11	442	14	2	447	14	2
12	447	13	2	452	14	2
13	451	13	2	457	13	2
14	455	13	2	461	13	2
15	459	12	2	465	13	2
16	463	12	2	469	13	2
17	467	12	2	473	13	2
18	471	12	2	477	13	2
19	474	12	2	481	13	2
20	478	12	2	485	13	2
21	482	12	2	489	13	2
22	485	12	2	493	13	2
23	489	13	2	497	13	2
24	493	13	2	501	13	3
25	497	13	2	505	14	3
26	501	13	3	509	14	3
27	505	14	3	514	14	3
28	509	14	3	518	15	3
29	514	15	3	523	15	3
30	519	15	3	528	16	3
31	524	16	3	533	16	3
32	529	17	3	538	17	4
33	535	17	3	544	18	4
34	541	18	4	550	18	4
35	548	19	4	557	20	4
36	555	21	4	564	21	4
37	563	22	4	572	22	4
38	572	23	4	575+	24	4
39	575+	25	4	575+	27	4
40	575+	28	4	575+	30	4
41	575+	30	4	575+	34	4
42	575+	35	4	575+	39	4
43	575+	41	4	575+	48	4
44	575+	52	4	575+	61	4
45	575+	75	4	575+	78	4
46	575+	78	4	575+	78	4
47	575+	78	4	575+	78	4

Appendix F: TABE Level D Reading Score Guide (DRC, 2017)

	Form 11			Form 12		
Raw Score	Scale Score	SEM	NRS Level	Scale Score	SEM	NRS Level
0	N/A	N/A	O/R	N/A	N/A	O/R
1	N/A	N/A	O/R	N/A	N/A	O/R
2	N/A	N/A	O/R	N/A	N/A	O/R
3	N/A	N/A	O/R	N/A	N/A	O/R
4	N/A	N/A	O/R	N/A	N/A	O/R
5	N/A	N/A	O/R	N/A	N/A	O/R
6	N/A	N/A	O/R	N/A	N/A	O/R
7	N/A	N/A	O/R	N/A	N/A	O/R
8	N/A	N/A	O/R	N/A	N/A	O/R
9	N/A	N/A	O/R	N/A	N/A	O/R
10	N/A	N/A	O/R	N/A	N/A	O/R
11	N/A	N/A	O/R	N/A	N/A	O/R
12	N/A	N/A	O/R	N/A	N/A	O/R
13	N/A	N/A	O/R	N/A	N/A	O/R
14	501-	16	3	501-	14	3
15	501-	16	3	501-	14	3
16	501-	16	3	501-	14	3
17	501-	16	3	501-	14	3
18	501-	16	3	501-	14	3
19	501-	16	3	501-	14	3
20	501-	16	3	501	14	3
21	501	16	3	505	14	3
22	506	16	3	509	14	3
23	510	16	3	513	14	3
24	515	17	3	517	14	3
25	520	17	3	521	15	3
26	524	17	3	525	15	3
27	529	17	3	529	15	3
28	534	18	3	533	15	3
29	539	18	4	537	15	4
30	545	18	4	542	16	4
31	550	19	4	546	16	4

	Form 11			Form 12		
Raw Score	Scale Score	SEM	NRS Level	Scale Score	SEM	NRS Level
32	556	20	4	551	16	4
33	562	20	4	556	17	4
34	568	21	4	560	17	4
35	575	22	4	566	18	4
36	582	22	5	571	18	4
37	589	23	5	577	19	5
38	597	25	5	583	20	5
39	606	26	5	590	21	5
40	616	27	5	597	22	5
41	616+	29	5	605	23	5
42	616+	31	5	614	25	5
43	616+	34	5	616+	27	5
44	616+	38	5	616+	29	5
45	616+	42	5	616+	32	5
46	616+	49	5	616+	37	5
47	616+	59	5	616+	44	5
48	616+	63	5	616+	56	5
49	616+	63	5	616+	68	5
50	616+	63	5	616+	68	5

Appendix G: TABE Level A Reading Score Guide (DRC, 2017)

	Form 11			Form 12		
Raw Score	Scale Score	SEM	NRS Level	Scale Score	SEM	NRS Level
0	N/A	N/A	O/R	N/A	N/A	O/R
1	N/A	N/A	O/R	N/A	N/A	O/R
2	N/A	N/A	O/R	N/A	N/A	O/R
3	N/A	N/A	O/R	N/A	N/A	O/R
4	N/A	N/A	O/R	N/A	N/A	O/R
5	N/A	N/A	O/R	N/A	N/A	O/R
6	N/A	N/A	O/R	N/A	N/A	O/R
7	N/A	N/A	O/R	N/A	N/A	O/R
8	N/A	N/A	O/R	N/A	N/A	O/R
9	N/A	N/A	O/R	N/A	N/A	O/R
10	N/A	N/A	O/R	N/A	N/A	O/R
11	N/A	N/A	O/R	N/A	N/A	O/R
12	N/A	N/A	O/R	N/A	N/A	O/R
13	N/A	N/A	O/R	N/A	N/A	O/R
14	N/A	N/A	O/R	N/A	N/A	O/R
15	538-	15	4	539-	17	4
16	538-	15	4	539-	17	4
17	538-	15	4	539-	17	4
18	538-	15	4	539-	17	4
19	538-	15	4	539-	17	4
20	538-	15	4	539-	17	4
21	538-	15	4	539-	17	4
22	538-	15	4	539-	17	4
23	538-	15	4	539-	17	4
24	538-	15	4	539-	17	4
25	538-	15	4	539-	17	4
26	538	15	4	539-	17	4
27	542	15	4	539	17	4
28	546	15	4	544	17	4
29	550	15	4	548	18	4
30	554	15	4	553	18	4
31	558	15	4	558	19	4
32	562	16	4	563	19	4
33	567	16	4	568	20	4
34	571	16	4	573	20	4

	Form 11			Form 12		
Raw Score	Scale Score	SEM	NRS Level	Scale Score	SEM	NRS Level
35	575	16	4	579	21	5
36	580	17	5	584	21	5
37	585	17	5	590	22	5
38	589	17	5	596	23	5
39	594	18	5	603	24	5
40	600	18	5	610	24	5
41	605	19	5	617	25	6
42	611	20	5	624	26	6
43	617	20	6	632	27	6
44	624	21	6	641	29	6
45	631	22	6	650	30	6
46	639	23	6	661	32	6
47	647	25	6	672	34	6
48	657	26	6	684	36	6
49	667	28	6	698	39	6
50	680	31	6	714	43	6
51	695	34	6	733	47	6
52	713	39	6	756	53	6
53	737	46	6	786	63	6
54	772	59	6	800	68	6
55	800	71	6	800	68	6
56	800	71	6	800	68	6

Appendix H: TABE Reading Level E Sample Questions (DRC, 2017)

Question 1: Which word has a short e vowel sound? a) bed b) dream c) near d) seed

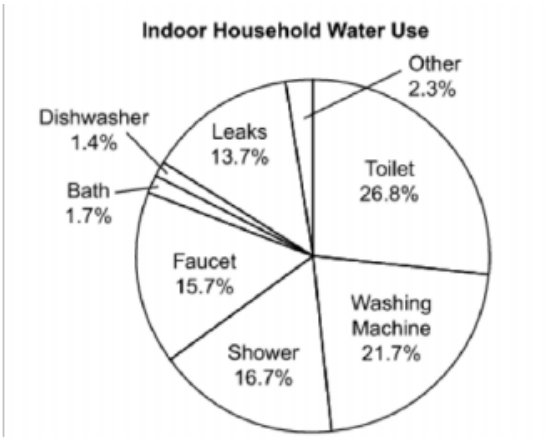
Read the article. Then answer questions 2 through 5.

Saving Water

1 It has been said that water is the new oil. For many years, countries have fought to control rights to oil. Like oil, clean water is a natural resource. And while water is considered to be a renewable resource, it can be difficult to recycle for human consumption. People can live without oil, but they cannot survive without water.

2 Over the past fifty years, the population of the United States has doubled. During the same amount of time, water use has tripled. Today, at least 36 states are short on water. People must work to save water. If they don't, they will soon not have enough. The cost of water will rise. It will not be easy to buy. Countries will elbow each other for rights to the water that remains.

3 There is good news, however. People can make changes to save water. Think about simple tasks such as brushing teeth, shaving, or washing dishes. Leaving the water running while doing these tasks wastes a precious resource. Running dishwashers and washing machines that are not full also wastes thousands of gallons of water. Even shower length is important. Taking showers that are two minutes shorter can save hundreds of gallons a month.



4 There are also ways to reuse water. Even water that seems dirty can be used again. For example, don't dump the water from a fish tank or a pet bowl. Instead, use it to water the plants. Fish water is full of nutrients. It will help the plants grow. Rainwater can be collected in a barrel or from gutters. Then it can be used to water plants and grass. People can wash the car or the dog on the lawn. This way, the grass gets watered at the same time. Also, think about replacing grass in some areas. Ground cover is a nice addition. Walkways or patios are helpful. And they add living space to homes.

5 Saving water is important. Doing so also saves money. Little leaks in pipes, taps, or pools can be expensive. If the water bill suddenly goes up, there may be a new leak. Listen for dripping. It's also easy to check the toilet. Put a few drops of food coloring in the tank. Then let the toilet sit without flushing. See if the water in the bowl gets colored. This means there is a leak in the seal.

6 Businesses and schools can also take steps to save water. They can replace equipment and change the way they do things. People can encourage these changes. Let businesses know that saving water saves money. In addition, the government may offer rebates for such changes.

7 People should try to save water whenever possible. Otherwise, the supply will soon run low. Be thoughtful about water use. It can make a big difference, both now and for the future.

Question 2

According to the article, which of these explains what will happen if people do not save water?

a) The population will decrease b) Other countries will sell water c) The price of water will increase d) People will be able to use dishwashers

Question 3

What is the main idea of the article? a) Water is as important as oil, so it should be used wisely b) When people make changes to save water, they also save money c) There are many ways to save water, an important natural resource d) If people waste water today, the supply of water will run low in the future

Question 4

Which two sentences support the answer to Part A? a) “For many years, countries have fought to control rights to oil” b) “If they don’t, they will soon not have enough” c) “The cost of water will rise” d) “Taking showers that are two minutes shorter can save hundreds of gallons a month” e) “Rainwater can be collected in a barrel of from gutters” f) “Little leaks in pipes, taps, or pools can be expensive”

Question 5 (refer to article above)

Look at the pie chart in the article.

Which section of the pie chart most clearly supports the information in Paragraph 5 of the article? a) the section of the pie chart labeled “Leaks” b) the section of the pie chart labeled “Toilet” c) the section of the pie chart labeled “Shower” d) the section of the pie chart labeled “Faucet”

Question 6

Which of these best states the authors’ opinion about water conservation? a) Fixing leaks will raise water costs b) People should always wash their cars on the lawn c) There are only a few simple tasks required to save water d) Reducing water use now is important for future generations.

Appendix I: Sample TABE Reading Level M Questions (DRC, 2017)

Read the passage. Then answer questions 1 through 7.

Whale Watching Across the blue, rolling waves, a dark hump rises from the sea. It slides out of sight as an enormous tail lifts and falls. As it does, another hump rises beside it and begins the same dance. Several people cheer from the pontoon boat. Some raise their cameras, while others lift binoculars to get a closer view. These whale watchers are getting what they hoped for—a view of gray whales migrating south. For thousands of years, whales have fascinated humans. However, until recent times, the average person did not have the chance to see these amazing creatures up close. The first opportunity arose in San Diego, California. There, in 1950, the Cabrillo National Monument was declared a public place to watch whales. Soon after, the first whale watching boats sailed from San Diego harbors. For $1, people could ride out into the ocean in hopes of seeing whale's close-up. The whale-watching boats became very popular. Soon similar boat trips were available from other seaports. Today millions of people around the world go whale watching every year. Interestingly, some whales are just as curious about humans as humans are about them. They may swim near a boat for hours, watching the passengers. Of course, this is a very exciting experience for those on board! "I was looking through the side of a glass-bottomed whale boat," says one whale watcher. "Suddenly, a blue whale was right next to me! Its eye looked straight at me as it swam by. Its body seemed to keep going and going. It was the most amazing experience of my life!" At up to 100 feet long, it is no wonder that the blue whale's body kept going. The blue whale is the largest mammal ever on Earth. Its body is the size of a passenger jet. Its tongue can weigh as much as an elephant. Depending on where a person whale watches, different types of whales may be seen. From the West Coast, people may see gray whales, blue whales, minke whales, fin whales, or killer

whales. East Coast whales include humpbacks, finbacks, and minkes. On both coasts, dolphins are a common sight. They enjoy eating the same shrimp-like krill as whales. Whale watchers also may catch sight of sea lions, seals, seabirds, and fish. Whale watching gives people a unique chance to see whales in their natural surroundings. For most, it is an experience they will never forget.

1. What type of whale can be seen by whale watchers on both the East Coast and the West Coast? A. gray whales B. blue whales C. minke whales D. humpback whales

2. Why do whales swim near whale-watching boats for hours? A. They are very interested in humans. B. They want passengers to take a lot of photos of them. C. They are hoping passengers will feed them some shrimp. D. They see their reflection in the boat and think it is another whale.

Read these two paragraphs from the article.

For thousands of years, whales have fascinated humans. However, until recent times, the average person did not have the chance to see these amazing creatures up close. The first opportunity arose in San Diego, California. There, in 1950, the Cabrillo National Monument was declared a public place to watch whales. Soon after, the first whale-watching boats sailed from San Diego harbors. For $1, people could ride out into the ocean in hopes of seeing whale's close-up. The whale-watching boats became very popular. Soon similar boat trips were available from other seaports. Today millions of people around the world go whale watching every year.

3. Which of these bests describes the structure that is used in the two paragraphs? A. These paragraphs compare and contrast several different ideas. B. These paragraphs relate events in the order in which they occurred. C. These paragraphs present a problem and then a solution to solve it. D. These paragraphs identify a cause and show the effect it has on the subject.

4. Read this sentence from the article. These whale watchers are getting what they hoped for—a view of gray whales migrating south. Which word means the same as migrating as it is used in the sentence? A. comparing B. pointing C. rising D. traveling

5. Which of these is the best summary of the article? A. Whale watching, popular since the 1950s, allows tourists to enjoy seeing whales in their native habitat. B. Whale-watching trips give tourists the chance to see different kinds of whales and also many different kinds of wildlife. C. Blue whales are very popular whales to see on whale-watching trips, while tourists occasionally get to see gray whales. D. Many times whales may only be seen by the use of binoculars during whale watching trips, but sometimes the whales are curious and come close to the boats.

Appendix J: TABE Reading Level D Sample Questions (DRC, 2017)

Quirky Quicksand

1 Quicksand has a reputation that it does not deserve. In a typical Hollywood movie scene, a character accidentally wanders into quicksand. Sometimes, the terrified character sinks quickly out of sight, leaving only a hat floating on the surface. At other times, a dramatic escape involves grabbing a nearby tree branch or the hand of another character.

2 It is true that you will begin to sink if you step into quicksand. However, you will not be sucked in and swallowed whole. The depth of quicksand ranges from a few inches to four feet. A person of average height probably will sink only waist deep.

3 Quicksand can form almost any place where water flows beneath a sandy surface. Some common areas for quicksand include river deltas, shores, and sandy creek beds.

4 The best condition for forming quicksand is when water seeps upward from an underground source and saturates an area of sand, silt, or other grainy soil. If you disturb (or step into) the quicksand, a loose layer of fine sand on top of the water changes into a thick, soupy liquid. The mixture settles to the bottom and packs tightly around your feet. The mud-like layer creates a strong suction, especially if you are wearing flat shoes or boots.

5 A person can float on quicksand just as he or she floats on water. The human body has a density of about 62 pounds per cubic foot. Quicksand has a density of about 125 pounds per cubic foot. Because a person is less dense than quicksand, the person will rise to the top when his or her feet are free from the paste-like sand at the bottom. The key is to remain calm and follow a few simple steps to escape.

6 Start by taking several deep breaths and trying to relax. Stretch out your back and lean backward slightly to increase your surface area. Soon, you will be able to move your legs. Rotate

one leg at a time in a slow circular motion. Water will flow down the leg into the thick sand on the bottom. Then as the bottom mixture thins, you can begin to free yourself. Move slowly and carefully. The area around you also might be soggy. Thrashing about wildly will cause you to sink deeper.

7 If you wander into an area of quicksand, do not ask another person to pull you out. In fact, pulling you from the thick mixture would require a great deal of strength. The suction that holds you in place is quite strong. Researchers at the University of Amsterdam found that the amount of force required to pull your trapped feet free is equal to the force that is needed to lift a medium-sized car. Your rescuer could be pulled into the heavy mixture, or you could be injured by the extreme stress placed on your arms.

8 Quicksand is not quite the mysterious force of nature that many believe it to be. An experience with quicksand usually is messier and embarrassing than it is dangerous. In any case, don't panic, and keep your wits about you. Afterward, you will have a most interesting story to share with friends and family!

1. Read this sentence from the passage. In any case, don't panic, and keep your wits about you. Which of these bests explains the meaning of the phrase "keep your wits about you"? A. stay quiet B. remain alert C. focus on intelligence D. have a helpful attitude

2. How does paragraph 4 contribute to the development of ideas in the passage? A. It explains why a person might disturb quicksand. B. It presents information about the water found in quicksand. C. It describes what happens when a person steps into quicksand. D. It states which shoes to wear in areas where quicksand is likely to form.

3. How does the movie scene described in paragraph 1 connect to the information in paragraphs 6 and 7? A. The paragraphs demonstrate that the Hollywood movie scenes are accurate. B. The

Hollywood movie scenes foreshadow the actions discussed in the paragraphs. C. The Hollywood movie scenes show what the paragraphs suggest will happen in quicksand. D. The paragraphs describe what to do differently from the actions in the Hollywood movie scenes.

4. Which sentence from the passage best expresses the author's attitude toward the threat of quicksand? A. "It is true that you will begin to sink if you step into quicksand." B. "The depth of quicksand ranges from a few inches to four feet." C. "If you wander into an area of quicksand, do not ask another person to pull you out." D. "An experience with quicksand usually is messier and embarrassing than it is dangerous."

Appendix K: TABE Reading Level A Sample Questions (DRC, 2017)

Read the passage. Then answer questions 1 through 7. Buying Local

1 In many European countries, people typically visit their local merchants on a daily basis. People travel to the local butcher, baker, and seller of fruits and vegetables to buy what they need for their meals that day. In America, however, often the opposite is true. Many Americans do their weekly food shopping at large grocery stores. These stores belong to chains1 with locations across the country. Many of the stores' products are not produced in the areas where the stores are located. Instead, fruits, vegetables, meats, and dairy products are shipped in from locations around the country and even around the world.

2 In the past, America's towns were filled with locally owned and independent specialty shops, much like the shops in Europe. In the 1920s, chain stores began to take over in America. By the 1950s, large supermarkets and the migration to suburban locations were taking hold in the country. These large stores offered a one-stop shop for all items at a lower cost than the local competition. Additionally, these stores often advertised a wider selection of products for the consumer. Americans were enticed by the convenience and affordability that chain stores were able to provide. In effect, chain stores pushed the local merchants and business owners out because small local businesses could not afford to compete. In recent years, a "buy local" movement has sprung up around the country to shift the attention back to local businesses. Buying local is a way to encourage people to support local businesses rather than large chains.

3 Supporters believe that buying local has several advantages. First, it supports the local economy. Because local small business owners are part of the community, they are interested in the welfare of that community. The money they make goes back into the community rather than to a large corporation. The employees hired by these local businesses often know a lot about the

businesses' products and provide great customer service. After all, the people they are helping could be their next-door neighbors!

4 Buying local also creates local jobs and helps to grow local businesses. Workers earn wages from these businesses, which they spend in their communities. In addition, businesses pay taxes, which helps to support local growth and development. Both wages and taxes contribute to the health and welfare of the community as a whole.

5 Buying local produce also has health benefits. Almost as soon as fruits and vegetables are picked, they begin to lose some of their nutrients. Instead of being picked and then shipped for hundreds of miles, locally grown produce goes from the farm to the table quickly, sometimes on the same day. Being able to buy freshly picked produce means that the food we put on our tables is as nutritious as it can be.

6 Shopping at large stores is certainly convenient, but buying local is a way for all of us to support our community and ourselves. 1 chain: large stores owned by the same corporation

1. Read the sentence from paragraph 4. Both wages and taxes contribute to the health and welfare of the community as a whole. Which key idea does the sentence support? A. Americans shop mostly at large chain grocery stores. B. Buying locally helps create local jobs and grow local businesses. C. Large grocery stores offer items at lower costs than local competition. D. Americans who buy locally are healthier than people who shop at chain stores.

2. Which of these is most likely the author's purpose for writing this article? A. The author wants the reader to understand how grocery stores have changed since the 1920s. B. The author wants the reader to understand that European grocery stores are superior to American grocery stores. C. The author wants the reader to understand that grocery stores stopped selling locally grown

products during the 1950s. D. The author wants the reader to understand that the new trend of buying local produce has many important benefits for Americans.

3. Part A How does the author provide effective support for the main idea of the article? A. The author states that buying local supports the local economy. B. The author states that there are problems with local chain stores. C. The author compares the local shopping trends of Americans with Europeans. D. The author compares American local chain stores with European markets.

Part B Which detail from the article best supports the answer to Part A? A. “In many European countries, people typically visit their local merchants on a daily basis.” B. “Many of the stores' products are not produced in the areas where the stores are located.” C. “In the past, America’s towns were filled with locally owned and independent specialty shops, much like the shops in Europe.” D. “Buying local is a way to encourage people to support local businesses rather than large chains.”

4. Part A Which statement explains how paragraphs 3 and 4 develop the author’s claim that buying local is a better option? A. The paragraphs suggest that buying local helps the country. B. The paragraphs suggest that buying local is more affordable. C. The paragraphs suggest that buying local helps local economies. D. The paragraphs suggest that buying local is healthier for people.

Part B Which sentence from the article best supports the answer to Part A? A. “Supporters believe that buying local has several advantages.” B. “The money they make goes back into the community rather than to a large corporation.” C. “The employees hired by these local businesses often know a lot about the businesses’ products and provide great customer service.” D. “After all, the people they are helping could be their next-door neighbors!”

5. Part A How does the author advance his or her point of view in the article? A. The author focuses on how Americans shop. B. The author focuses on how products are shipped throughout the world. C. The author compares the healthier shopping habits of Europeans with the habits of Americans. D. The author compares the economic benefits of shopping at smaller stores rather than large chain stores.

6. Part B Which sentence from the article best supports the answer to Part A? A. “People travel to the local butcher, baker, and seller of fruits and vegetables to buy what they need for their meals that day.” B. “Many Americans do their weekly food shopping at large grocery stores.” C. “Many of the stores’ products are not produced in the areas where the stores are located.” D. “Buying local also creates local jobs and helps to grow local businesses.”

7. Part A Which statement represents a claim made by the author in paragraph 5? A. Locally grown produce is organic. B. Locally grown produce is rarely shipped. C. Locally grown produce has less chemicals. D. Locally grown produce has more vitamins. Part B Which two details from the article best support the answer to Part A? A. “Buying local produce also has health benefits.” B. “Almost as soon as fruits and vegetables are picked, they begin to lose some of their nutrients.” C. “Instead of being picked and then shipped for hundreds of miles, locally grown produce goes from the farm to the table quickly, sometimes on the same day.” D. “Being able to buy freshly picked produce means that the food we put on our tables is as nutritious as it can be.”

8. Part A Which statement describes how the author explains the impact of grocery chain stores on local economies? A. Chain stores hire workers outside the community. B. Chain stores provide a larger selection of products. C. Chain stores take tax dollars from the local community. D. Chain stores import goods and services from other countries. Part B Which sentence from the

article best supports the answer to Part A? A. “Instead, fruits, vegetables, meats, and dairy products are shipped in from locations around the country and even around the world.” B. “The money they make goes back into the community rather than to a large corporation.” C. “After all, the people they are helping could be their next-door neighbors!” D. “Instead of being picked and then shipped for hundreds of miles, locally grown produce goes from the farm to the table quickly, sometimes on the same day.”