Old Dominion University
ODU Digital Commons

STEMPS Theses & Dissertations | STEM Education & Professional Studies

Summer 6-2022

Career Literacy: Developing, Validating, and Establishing the Reliability of the Career Literacy Continuum Scale

Kesha S. Valentine
Old Dominion University, kesha.s.valentine@gmail.com

Follow this and additional works at: https://digitalcommons.odu.edu/stemps_etds

 Part of the Secondary Education Commons, and the Vocational Education Commons

Recommended Citation

Valentine, Kesha S.. "Career Literacy: Developing, Validating, and Establishing the Reliability of the Career Literacy Continuum Scale" (2022). Doctor of Philosophy (PhD), Dissertation, STEM Education & Professional Studies, Old Dominion University, DOI: 10.25777/wkhq-a327
https://digitalcommons.odu.edu/stemps_etds/127

This Dissertation is brought to you for free and open access by the STEM Education & Professional Studies at ODU Digital Commons. It has been accepted for inclusion in STEMPS Theses & Dissertations by an authorized administrator of ODU Digital Commons. For more information, please contact digitalcommons@odu.edu.

CAREER LITERACY: DEVELOPING, VALIDATING, AND ESTABLISHING THE RELIABILITY OF THE CAREER LITERACY CONTINUUM SCALE

by

Kesha S. Valentine

B.S. Marketing May 1998, George Mason University

Master of Business Administration August 2000, Marymount University

Ed. S. Business Education August 2007, University of West Georgia

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY IN EDUCATION

OCCUPATIONAL AND TECHNICAL STUDIES

OLD DOMINION UNIVERSITY

June 2022

Approved by:

Michael Kosloski (Director)

Petros Katsioloudis (Member)

Cherng-Jyh Yen (Member)

ABSTRACT

CAREER LITERACY: DEVELOPING, VALIDATING, AND ESTABLISHING THE RELIABILITY OF THE CAREER LITERACY CONTINUUM SCALE

Kesha S. Valentine
Old Dominion University 2022
Director: Dr. Michael Kosloski

The purpose of this study was to develop a valid, reliable measure of career literacy skills called the Career Literacy Continuum Scale (CLCS). Career literacy is a person's ability to read, understand, evaluate, and make decisions based on career-related information. The study participants were adolescents in grades 6 - 12 who attended public school in the southeastern United States. This study used an instrumentation research design and was conducted in two phases, item generation followed by test analysis and optimization.

Validity was established throughout the process by using content experts and establishing the item and scale validity indices. Item response theory is used in this study to determine item and test statistics and characteristics. The model fit was determined after confirming unidimensionality by estimating the one-, two-, and three-parameter models for comparison using the AIC, BIC, and the likelihood ratio X^2. The two-parameter model provided the best model fit. Using the two-parameter estimation results, the item- and test-characteristic curves, in addition to difficulty and discrimination data, were evaluated resulting in the removal of four items.

The reliability of the CLCS was established using estimations from the final version of the instrument. The KR 20 coefficient alpha, differential item functioning, and item- and test-information functions were analyzed. The CLCS is reliable with an internal consistency of $\alpha =$

0.91 and scale validity index of 0.93. Differential item function results provided additional validity because there were very few items that functioned differently among groups.

Based on the analysis of validity and reliability data, the Career Literacy Continuum Scale can be considered both reliable and valid. According to the test information function data, the CLCS provides the most information for adolescents at $\Theta = -1.25$. Additional items could be field-tested to provide more testing options, specifically including more difficult items or creating a battery of tests based on specific skills. Implications for career development, legislation, and curriculum are discussed along with recommendations for future research.

Copyright, 2022, by Kesha S. Valentine, All Rights Reserved.

I dedicate this work to my mom, Sheila Holmes, and the memory of my dad, Kurt Valentine, who modeled work ethic every day, even in the worst of times. Also, to Ethan and Eli, you are so integral to my very being, I live and breathe so that I can prepare you to take advantage of the best this world has to offer. Your willingness to put up with my schoolwork means more to me than you will ever know. Ethan, all the questions you asked to truly understand my research and your constant validation of its importance makes me swell with so much love that sometimes it alone has propelled me to keep moving forward. Eli, the showers of affection you gave me so generously were daily reminders of why I had to keep working hard.

ACKNOWLEDGEMENTS

I would like to first acknowledge my Lord and Savior, Jesus Christ, who has strengthened me and grown me through this process.

I am more fearful of running out of paper than running out of thanks. I am incredibly grateful for each person who has poured a little, or a lot, of love, thoughts, encouragement, and prayers into my boys and my life. I could not have done this without the support of my family and friends, most especially, my mom, Sheila Holmes, who has been my lifelong champion. Mom, your support through this process and always has been a bedrock from which I could stand firm and propel towards my goals and aspirations. For that, and so many things, I want you to know that I thank you from the depths of my being.

I feel like this Ph.D. is a trophy for my entire family, as you have stood with me, offered me your shoulder, prayed for me, and encouraged me to keep going in the face of the greatest adversity I have ever faced. My dear grandma, Vernell Holmes, I thank you for reminding me in your own way, that the Lord is the source of my strength. Remembering this, and your poetic recitations have pulled me up from dark times. My aunts and uncles have given me love, laughter, prayer, and practical advice, all of which gave me fuel to solve problems and just keep going. Reflecting on your approach to and triumph over trying times has given me the determination to work hard, despite the reality of my situation at times. Thank you, Aunt Nene, Uncle Herman, Aunt Darlene, Aunt Zoe, Aunt Candy, Uncle Reid, and especially, Uncle Mouse. The days we rode through the city inspired this research, and if given the choice, I would spend a lifetime working to make a difference in the situations we observed.

I have a special acknowledgment to my immediate Valentine clan – as I know you have all stood with me in spirit, being the only other people with our dad's legacy of love and work

ethic running through our veins. Sharmaine, Natalie, and Alonzo thank you for being exceptionally patient with me. Thank you for always letting me just pop in without making me feel guilty for the times I missed and for always being my cheerleaders, unconditionally.

I am grateful to have grown closer to my cousins over these past few years. Courtney Heard and Shanice Golden, you may not have known that there were times that you held me up from afar and pushed me along. There were days when I did not think I could make it through one more hurdle and you answered the phone or text and made me laugh, gave me perspective, and *made* me stand up and own the power I possessed from within. I will take that with me forever.

There is no way that I could have made it through this process without all of my family, the family I was born into, or the family that I have chosen, or who have chosen me, along my journey. My Street family has taken me in as one of their own and shown me love and laughter, in exchange for just being myself. Bruce McMackle, you will never know the impact of your friendship over these past few years, your just get it done attitude has frustrated me countless times but, in the end, I walked away feeling stronger and more in control. Thank you for making me laugh and being patient while I rediscovered who I am. Sandra and Dwayne, thank you for encouraging me to be silly and really understanding what family can look like. Ronald, you inspired my next endeavor, getting down and dirty with some power tools. Pop, it will always be "Christmas time."

I have to give a special thank you, and virtual hugs, to my girls who have helped me through this Ph.D. During the summer of 2017, I met some amazing women who continue to be thought partners and champions. Thank you for letting me talk through this concept, ad nauseum over these years. I am so proud of each of you, and I am looking forward to witnessing the mark

you make on the world. More than that, I am honored to call you my friend. Mariam Abdelhamid, expecting your visit for our writing time motivated me to sit down and get the words on the page, especially on days when I was in my feelings. Adriane Graham, too many young adults are waiting on your research. There are times that they may have to be your motivators – you got this soror. Dr. Deia Champ, Dr. Strickland-Davis, Terri Pollard, Dr. Sherri Watson, and Dr. Mylene Culbreath, I appreciate your example and willing counsel on my research and a host of other questions. My dear Dr. Donna Fenton, ever since we met, you have always shown me such care. I admire the care and diligence you take in all of your endeavors; I hope it rubs off on me.

Although I am so excited and could thank countless other people for the support they have given me, I cannot close without offering a sincere thank you to my committee members Dr. Michael Kosloski, Dr. Petros Katsioludes, and Dr. Cherng-Jyh Yen. I can only imagine the amount of work involved in supporting the research of young scholars, but I certainly appreciate the time and attention that you have given to me. Dr. Kosloski, I am so grateful for the mentorship that you have given me over these past few years. It has been so exciting to come to realize what it truly means to be a scholar, my chief objective for obtaining my Ph.D.

TABLE OF CONTENTS

Page

List of Tables xiii
List of Figures xv
CHAPTER I INTRODUCTION 1
Problem of the Study 4
Research Objectives 7
Background, Significance, and Theory of Action 7
Career Literacy 7
Career Readiness 8
Significance 10
Postsecondary Preparation Across the United States 12
Postsecondary Preparation in Virginia 12
Theory of Action 14
Limitations 18
Assumptions 18
Procedures 19
Item Generation and Instrument Development Process 19
Study Administration 20
Sample 22
Data Analysis 22
Definition of Terms 23
Summary 24
CHAPTER II Literature Review 26
Background Career Theory 27
Super's theory 27
Holland's Theory 27
Gottfredson's Theory of Circumscriptions and Compromise 28
Social Cognitive Career Theory 29
History of Career Literacy 30
Establishing Definitions of Other Literacies 33
Career Literacy Conceptualized 34
Career Literacy Concepts Operationalized 35
Career Decision Making 38
Efficacy 38
Indecision 39
Lack of Information 39
Environmental Barriers 40
Current Approaches to Mitigating Career Decision Making Problems 41
Academic Approaches 41
Inventories/Assessments 44
Personal Approaches 45
Environmental "Person" Factors 46
Parental Influence 47
Gender 49

Socioeconomic Status 51
Other Barriers 51
Assessments & Intervention 53
Data-Driven Decision Making 53
Current Career Development Measurement Highlights 54
Career Decision Efficacy Scale (CDES) 55
Career and Educational Decision Self-Efficacy Inventory for Secondary Students 55
Item Response Theory 57
Unidimensionality 58
Local Independence 59
Model Selection 59
Goodness of Fit (GOF) 60
Analysis of Model Fit 61
Analyzing Item Response Theory Data 62
Item Level Data 62
Test Level Data 63
Test Development with Item Response Theory 64
Instrument Reliability with Item Response Theory 65
Summary 66
CHAPTER III METHODS AND PROCEDURES 67
Research Objectives 69
Instrument Development 69
Knowledge and Skills to be Measured 70
Expert Review for Scale Validity 70
Administration of the Pilot Study 72
Field Study Sample 73
Demographic Data 74
Sample Size 76
Participant Recruitment 77
Field Test Administration 78
Data Analysis Plan for the Career Literacy Continuum Scale 80
Data Integrity 80
Missing Data 81
Coding 82
Test Specification for the CLCS 82
RO_1 Demonstrate Validity of the Career Literacy Continuum Scale 83
RO_2 Determine the Best Fitting Model for the Career Literacy Continuum Scale 84
Assumption Tests 84
Unidimensionality 84
Local item independence 86
Monotonicity 86
Model Fit Test 86
Item Analysis and Selection 87
Construction of the Career Literacy Continuum Scale 89
RO_3 Demonstrate the Reliability of the Career Literacy Continuum Scale 90
Reliability Analysis of the Career Literacy Continuum Scale 90

Coefficient alpha 91
Item information data 91
Test information data 91
Summary 92
CHAPTER IV FINDINGS 95
Formative Preparation of the CLCS for Field Testing 96
RO_1: Demonstrate validity of the Career Literacy Continuum Scale 96
Test Blueprint 97
Instrumentation for the Career Literacy Continuum Scale 97
Expert Review of Content Validity 102
Face Validity 105
Reading Level 106
Pilot Test Administration 106
Pilot Study Recruitment 107
Participant Profile 107
Pilot Test Data 107
Impact of Formative Preparation on Field Test Instrument 110
Field Test Administration Sampling Procedure 112
Participants 113
RO_2: Determine the Best Fitting Model for the Career Literacy Continuum Scale. 115
Local Item Independence 116
Monotonicity 117
Model Fit Estimation 121
1PL Model Evaluation 121
2PL Model Evaluation 125
Comparing the Initial Models 128
Test Adjustment 129
2PL After Adjustment 131
RO_3: Demonstrate Reliability of the Career Literacy Continuum Scale. 134
2PL Item Information Function (IIF), After Adjustment 136
2PL Test Information Function (TIF), After Adjustment 136
CHAPTER V SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS 138
Summary of the Study 138
Summary and Synthesis of Results (to RO) 140
RO_2: Determine the Best Fitting Model for the Career Literacy Continuum Scale 141
Recommendations for Future Research 151
Item Development 151
Scoring and Additional Development 152
Modified Instrument or Protocol 152
Additional Field Testing Specifically with Late-Age Adolescents 154
Conclusion of the Study 154
REFERENCES 156
APPENDIX A HUMAN SUBJECTS APPROVAL LETTER (ODU) 185
APPENDIX B INFORMED CONSENT 186
APPENDIX C ITEM DETAILS 189
APPENDIX D INTERVIEW PROTOCOL 192

APPENDIX E RESULTS OF PRINCIPAL COMPONENTS ANALYSIS 193
APPENDIX F 2PL ICC IIF GRAPHS ALL ITEMS..... 194

LIST OF TABLES

Table Page

Table 1 Examples of Career Literacy Skills by Career Readiness Theme 10

Table 2 Graduation Accountability for Post-Secondary Preparation 13

Table 3 Item Generation, Iterative Process 21

Table 4 Field Test Administration Process 22

Table 5 Study Data Analysis Process 23

Table 6 Existing literacy definitions 33

Table 7 Career Literacy Concepts and Skills 36

Table 8 Sample of Items from the CEDIS 56

Table 9 Model Fit Analysis Criteria 62

Table 10 Initial Scale Validity Protocol 72

Table 11 Exploratory Factor Analysis Unidimensionality A Priori Analysis Criteria 85

Table 12 Confirmatory Factor Analysis Unidimensionality A Priori Analysis Criteria 85

Table 13 Goodness of Model Fit Test Analysis Criteria 87

Table 14 IRT Discrimination Analysis Criteria 88

Table 15 Summary of Evidence to Support Research Objectives 94

Table 16 Blueprint of the CLCS 99

Table 17 Item Content Validity Index 104

Table 18 *Career Literacy Skills Not on CLCS* 111

Table 19 Participating Student Demographics 114

Table 20 Analysis of FA Results 116

Table 21 KMO Results by Item 117

Table 22 Confirmatory Factor Analysis Results 118

Table 23 1PL and 2PL Model Fit Estimation, sorted by 2PL increasing discrimination 120

Table 24 Model Comparison Data, 1PL and 2PL all items 129

Table 25 Estimation After Test Optimization, Sorted by 2PL Increasing Discrimination 132

Table 26 Comparison of Item Difficulty Before and After Optimization..... 133

Table 27 *Differential Item Function by Group* 135

Table 28 Number of Items Correct by Grade with Adjusted CLCS 135

LIST OF FIGURES

Figure Page

Figure 1 Theory of Action: Impact of Assessing Career Literacy 15

Figure 2 Test Information Function Interpretation 64

Figure 3 Career Literacy Continuum Scale development process 68

Figure 4 Interpretation of IRT Graphs 89

Figure 5 Scree Plot of Eigenvalues 116

Figure 6 ICC 1PL CTCRED 119

Figure 7 ICC 2PL CTCRED 119

Figure 8 1PL ICC, all items 122

Figure 9 1PL IIF, all items 123

Figure 10 1PL TCC, Expected Number Correct Responses 124

Figure 11 1PL TIF, all items 125

Figure 12 2PL ICC, all items 126

Figure 13 2PL IIF, all items 127

Figure 14 2PL TCC, Expected Number Correct, all items 127

Figure 15 2PL TIF, all items 128

Figure 16 ICC Removed Items 130

Figure 17 IIF removed items 130

Figure 18 2PL ICC After Adjustment 133

Figure 19 2PL TCC After Adjustment 133

Figure 20 2PL IIF After Adjustment 136

Figure 21 2PL TIF After Adjustment 137

CHAPTER I

INTRODUCTION

School is a significant influence on career preparation. By adolescence, students are beginning to make choices that impact the remainder of their secondary education and post-secondary lives (Marcionetti & Rossier, 2017). One approach to preparing students to make these career-related decisions is by encouraging the completion of interest, personality, and efficacy inventories (Kulcsár, et al., 2020). A structured method for understanding students' academic abilities to make career-related decisions will help stakeholders offer appropriate interventions where necessary (Balfanz, 2012). Appropriate interventions will assist in providing students with the opportunity to make well-informed, intentional career-related decisions during their academic experience.

Although many factors influence an adolescent's school and career decisions, parents and guardians are the most significant influencers of their student's behaviors (ACTE, 2006). Research also supports factors such as diverse experiences, attitudes, and goals, in addition to a feeling of school connection, as motivators for successful school matriculation (Lapan, et al., 2017). School counselors offer students personality and career interest inventories, in addition to planning career days and career fairs. Surprisingly, given the weight and potential rewards or consequences of career exploration, those tasks do not rate in the counselor's top five most frequent daily tasks (Boyington, 2018). The Young Adult Library Services Association (YALSA; 2018) cites critical literacy and career services as two prominent needs that must be addressed for teens. Without an approach that explicitly establishes personal connections, the exercise of career research is a formality rather than an effective intervention (Tang et al., 2008). Exposure is important, but timing and deliberate connections are critical (Guillon et al., 2004).

This study was designed to develop a scale that will measure career literacy on a continuum. The results of this scale could be shared with students, educators, families, and stakeholders so that personalized, targeted support can be offered in deficit areas. When students are unclear about their next steps, the result is often indecision or no self-directed career choice behavior. On the other hand, students who feel a locus of control take action towards necessary career-related tasks (Savickas, 1990). Concern exists around career decisions being made too early (ACTE, 2006). More serious concerns exist for the groups of students who were traditionally directed not to pursue college and later included in the college for all educational trends (ACTE, 2006). This is unfortunate because many of these students may have a limited context for making wise career decisions or having a clear awareness of the career and income opportunities that exist (ACTE, 2006). Measuring career literacy and providing specific interventions may be an important step in creating equitable futures for students. Additionally, it will provide a rationale for the inclusion of career literacy as a developmentally appropriate curricular concept for students.

Career preparation begins during students' K-12 educational paths. Before graduation, students are exposed to various role models, community examples, hands-on learning opportunities, and their parents, the most important influence of all (Olle & Fouad, 2015; Trice, 1991). However, the expectations are not equitable across race, gender, parental involvement, and poverty levels. These contextual affordances, or lack thereof, contribute to longstanding inequitable outcomes across marginalized student populations (ACTE, 2006).

To many, the term "career literacy" seems synonymous with the term "career readiness." A search for the term career readiness will produce a variety of responses with the majority favoring ideas involving competencies and the preparation and skills necessary to acquire and

perform work on a job (Malin et al., 2017). In contrast, career literacy, as defined for this research, broadly refers to the background knowledge and abilities students need to be able to understand, interpret, evaluate, and make decisions related to career information (Valentine & Kosloski, 2021). The definition of career literacy, as synthesized from other literacies like information, health, and food and nutrition, is the functional, interactive, and critical skills a student needs to have meaningful interaction with career-related information. Doustmohammadian et al. (2017) define functional skills as the most basic skills a student needs to read simple [career] messages, interactive skills as the ability to manage [career] skills in collaboration with professionals, and critical skills as the ability to analyze [career-related] information critically. In other words, career literacy represents the ability to understand, interpret, evaluate, and make decisions related to career information (Doustmohammadian et al., 2017; Lau & Yuen, 2014; Larsen, 2007; Vidgen & Gallegos, 2014).

Career readiness represents the skills a student will need to acquire and maintain employment while career literacy represents the ability to understand, interpret, evaluate, and make decisions related to career information; career literacy is a precursor to career readiness. To provide more equitable opportunities for students in their postsecondary pursuits, students need to become career literate throughout their K-12 education experience. A Career Literacy Continuum Scale (CLCS) can provide educators and family members with individual student data that can be used to offer appropriate experiential and instructional intervention.

When educators and families can help to reverse the impact of negative affordances, students will experience an increase in secondary and post-secondary outcomes like achievement, opportunity, and an overall more equitable future (Lapan, et al., 2017). Measuring career literacy on a continuum will provide educators and counselors with enough information to

develop interventions specific to students' grades and needs. The process of moving along the continuum may create a more level playing field for all students, especially those from underserved backgrounds.

A measure of students' career literacy will give educators an entry-point to talk to students and their parents about specific experiences needed to move students along their career literacy continuum. Following these recommendations may allow students to gain the background knowledge needed to achieve equal career opportunities and the prospect for more equitable post-secondary outcomes.

Problem of the Study

The current employment situation illustrates the utility of a college degree which no longer provides the level of job security that it once did (Mann et al., 2020; Symonds et al., 2011). The shifting age of the work population is creating access barriers for new graduates because jobs requiring entry-level skills are not opening at the same rate that graduates are seeking jobs (Gordon, 2014). Similarly, many positions that might have been available to the youth community are held by older Americans who are considered more favorable employees (Elder, 2015; Gordon, 2014). Adult job growth exceeds the youth rate, which has been decreasing annually since 2018 (Gammarano, 2019). This phenomenon is problematic because early labor experiences impact future access to the labor market (Elder, 2015; Mann et al., 2020).

Compounding the problem faced by American youth is the rate of completion of preparatory programs. Symonds et al. (2011) pointed out the results of post-graduation endeavors for students of all backgrounds, with about 56% of students who attend universities graduating in four years. Overall, the United States has the highest post-secondary dropout rate in the industrialized world. According to Hughes (2012), 25 – 44% of high school graduates earn an

associate degree or higher. The number of students who start college is significantly higher than the number of students who complete their degree. Regarding bachelor's degrees, African American, Hispanic, and White students complete within 6 years at rates of 40.5%, 54%, and 64% respectively (National Center for Education Statistics [NCES], 2019). This comparison is even more disparate for non-majority students where "only 9% of youth in the lowest income quartile complete a four-year degree by age 24 compared to 77 percent in the highest income quartile" (Pell Institute, 2018). As a result, the ability to make critical, informed career decisions during high school is increasingly important.

The Carl D. Perkins Career and Technical Education Improvement Act (Perkins IV; 2006) was instrumental in creating a sustainable funding source to improve career and technical education (CTE) programs in the United States. Its reauthorizations have been intended to strengthen the connection between CTE and core academic instruction. The most recent iteration, the Strengthening Career and Technical Education for the 21st Century Act (Perkins V; 2018) includes an emphasis on academic knowledge and employability skills. Career literacy may be a key indicator of these critical employability skills.

Students who have a career projection for themselves are more engaged in school (Hung-Chang & Mei-Ju, 2014). Student engagement is integral to academic success (Fredericks et al., 2004). Allowing students to explore careers and encouraging the development of expectations could allow them to connect with a career earlier in their course of academic study which, in turn, may raise the level of engagement in schools. With an increased level of engagement, a by-product of career literacy could be increased academic success.

Educators, administrators, and lawmakers use data to make decisions about the curricula and experiences offered to students (Brumwell et al., 2017). The data come from formal and

informal measures taken by students. Analyzing these data will provide the meaningful results necessary to prepare or recommend individualized experiences designed to help students acquire career literacy skills. Currently, limited instruments exist to measure students' ability to understand, interpret, evaluate, and make decisions related to career information (Kulcsár et al., 2020).

A person's career impacts nearly every aspect of their life and that extends to the opportunities to which their family has access (Diemer et al., 2020). The interesting paradox is the most significant career development happens from childhood to late adolescence (School, 2001; Tang et al., 2008; Watson & McMahon, 2005). Children begin to restrict the career options they will consider as they age, especially during early adolescence (Gottfredson, 1981; Tang et al., 2008). Gibbons and Shoffner (2004) offer career exploration as one-way adolescents may stay open to considering viable careers past the early adolescent stage. Providing interventions is a strong way to counteract negative growth in adolescents (Bandura et al., 2001). Super's theory encourages the use of assessment to inform career counseling (1953). Most counselors use instruments based on career theory to support their students (Nauta, 2010).

Other career theories have inspired scales that measure career interests, career decision-making, career self-efficacy, and career readiness (Kulcsar, 2020). These scales measure students' self-reported conditions at the point in time they took the measurement. However, skills tests that determine how well-prepared students are to interact with or make decisions based on these types of career-related tools have been difficult to locate. Without knowing a student's ability to read, understand, interpret, and make decisions on career-related information, the results of these measures may not take into account their actual ability. Therefore, this study

focuses on creating an instrument to measure career literacy in adolescents that may serve as a support for career counseling.

The purpose of this study was to address this gap by creating and validating a scale to measure adolescent students' career literacy. As a result of this study, stakeholders will have an instrument that can identify areas for improvement in students' career literacy preparation and inform parents, educators, and other stakeholders about ways to more effectively assist students in their development.

Research Objectives

The following research goal and objectives were established to guide this study:

Research goal: Create a valid, reliable measure of a student's career literacy. For the purpose of this study, the new scale will be called the Career Literacy Continuum Scale (CLCS).

Research objectives:

RO_1: Demonstrate the validity of the Career Literacy Continuum Scale.

RO_2: Determine the best fitting model for the Career Literacy Continuum Scale.

RO_3: Demonstrate reliability of the Career Literacy Continuum Scale.

Background, Significance, and Theory of Action

Career Literacy

Career literacy is to career readiness as early literacy is to school readiness. It is the set of skills that enables students to understand, interpret, evaluate, and make decisions related to career information. It follows the pattern and measurement of other complex literacies, like financial and food and nutrition literacy, that encompass skills students develop over a period of time, with the ultimate aim of preparing them for their adult lives.

In this study, career literacy refers to the set of functional, interactive, and critical knowledge, skills, and behaviors/abilities that individuals need to access, evaluate, communicate, research, and plan for their future. Patterned from food and nutrition literacy, the definition of career literacy is broken into three types of skills: functional, interactive, and critical. Functional career literacy, which represents the most basic capabilities, is "concerned with basic reading and writing skills necessary to understand and follow simple [career-related] messages" (Doustmohammadian et al., 2017, p.3). Interactive career literacy represents "an advanced literacy which includes cognitive and interpersonal skills needed to manage [career-related] issues in partnership with professionals" (Doustmohammadian et al., 2017, p.3). Critical career literacy is "the ability to analyze [career-related] information critically, increase awareness, and participate in action to address barriers" (Doustmohammadian et al., 2017, p.3).

Career Readiness

The college and career readiness movement was a response to the need to prepare students for their post-secondary opportunities (ACTE, 2006). ERIC (2020) defines the career readiness descriptor as a "variable construct describing the knowledge, skills, and attitudes needed to secure and retain adequately compensated employment" (para. 1). Goleman (1998) adds non-technical skills that are "prime qualities that make and keep us employable" (p.4). College readiness refers to a student's literacy preparedness for college text (Wei et al., 2016). Most of the readiness preparation is focused on college (Barton & Coley, 2011).

Throughout a student's life, family plays a significant role in literacy development (Jarrett & Coba-Rodriguez, 2017). At the same time, Lapan et al. (2017) found that counseling services also impact the success of college and career readiness. Along the same lines, career and

technical education (CTE) offers students the opportunity to learn career skills in school and serves as another way to prepare to reach postsecondary goals (Gordon, 2014).

"School readiness data for elementary, middle, and high school students is often not available, making it difficult for educators to discern what critical skills students lack, and will need focused attention to acquire" (Balfanz, 2012, p.12). A mirrored concern in CTE is the variance in definitions states have assigned to career readiness. Without standard definitions, progress monitoring or program comparison becomes a difficult task. To combat a lack of comparable data, ACTE (2006) and state education agencies recommended the development of clear goals and assessments to measure a student's career and college readiness. Along the path to this goal, Mishkind (2014) analyzed the college and career definitions offered by 34 states to help standardize the nomenclature and developed six categories that best represented those skills: academic knowledge, critical thinking and/or problem-solving, social and emotional learning, collaboration and/or communication, grit/resilience/perseverance, citizenship and/or community involvement. Because career literacy is a precursor to career readiness, its nomenclature should be similar for concepts and skills related to career readiness.

Mishkind's (2014) synthesis of the state-level career readiness definitions provides a starting point for examining career literacy within the context of career readiness. In this way, the skill development may also be considered for a more holistic integration in other curricular areas. The identified career literacy skills and concepts support the academic knowledge, critical thinking, grit/resilience/perseverance, and social-emotional learning categories. Table 1 shows an example of the connection between the themes identified in career readiness and career literacy.

Table 1

Examples of Career Literacy Skills by Career Readiness Theme

Theme	Career Readiness definition highlights (Mishkind, 2014)	Related Career Literacy Skills (Valentine & Kosloski, 2021)
Academic knowledge	"Content, knowledge and skills…in English and mathematics" (p.3) "be prepared to take credit-bearing postsecondary courses" (p.3)	1. Manipulate basic math facts 2. Identify basic requirements of a job 3. Identify steps needed to gain required skills
Critical thinking	"Reasons, researches, analyzes logically" (p.3) "Evaluates and/or applies prior knowledge" (p.3) "Distinguishes between opinions, interpretations, and facts" (p.3)	1. Analyze simple and complex written instructions 2. Analyze the credibility of a source 3. Calculate the consequences of irrational long-term decisions
Grit/ resilience/ perseverance	"Goal setting, persistence, and resourcefulness" (p.4)	1. Acknowledge the importance of persistence and follow through 2. Advocate for oneself with respect to ones' career 3. Immerse in field experiences to gain a better understanding of a career
Social and emotional learning	"Collaboration, communication, and/or social and emotional learning skills" (p.4)	1. Articulate ones' own skills/values, transferable skills, and career goals 2. Collaborate with others and be open to other's ideas 3. Knowledge of your own bias and its impact on your assumptions

Significance

"Critical literacy has to do with an ability to challenge the status quo of the social order and identify meaningful action to help shift power imbalances" (Kumasi, 2011, para 4). As a means of empowering youth to grasp knowledge of and make decisions concerning their futures, it is increasingly important to understand the current state of their career literacy, especially, but

not only for youth who represent marginalized populations. To achieve post-secondary success, marginalized youth who are drawn to for-profit colleges that promise ambitious outcomes in short periods, often at great expense, walk away with considerable debt but without the desired set of credentials (Holland & Deluca, 2016). While this example is connected to a study for underserved youth, they are not the only students in danger of being ill-prepared to make decisions about post-secondary opportunities. The employment outcomes are at such critical levels worldwide that the United Nations has promoted the development of jobs for youth as a worldwide sustainable goal (United Nations, 2020). Regardless of a student's socioeconomic background, it is becoming imperative that they have a well-thought-out plan for their post-secondary track, especially with older Americans working longer, thereby reducing the number of available positions for new college graduates (Gordon, 2014; Mann et al., 2020).

Career literacy, like media literacy, information literacy, and other complex literacies that are measured, is a discipline that demands a student's growth and improvement over time to improve achievement in those areas. Measuring career literacy will provide educators with data about students' abilities and place them on a skills-based continuum so that skills-based interventions can be made and progress measured. Increased ability in the area of career literacy should provide a positive impact on goal setting, outcome expectations, and self-efficacy, in addition to improving their interactions and choices with career-related information. These characteristics – goals, outcome expectations, and self-efficacy – which ebb and flow through adolescent development, are the main tenets of the Social Cognitive Career Theory (Lent et al., 1994).

A student's literacy level is influenced by a myriad of factors, including their experiences, race/ethnicity, socioeconomic status (SES), and their parents' education levels

(Davis-Kean, 2005; Dubow et al., 2009; Wiggan, 2007). SCCT identifies these person-factors as contextual affordances which are the foundation of career-choice behaviors. Career literacy, or a student's ability to understand, interpret, evaluate, and make decisions related to career information, is also a representation of a student's contextual affordances. Students who feel efficacy in the area of career literacy should make more informed career decisions, which will, in turn, improve their engagement in school and positively impact their post-secondary outcomes (Castellano et al., 2011).

Postsecondary Preparation Across the United States

Of the 44 states that have provisions for individual learning plans for students, some beginning in the 6th grade, 34 states mandate the plan. Of the states with a provision for an individual learning plan (ILP), regardless of the mandate for graduation accountability metrics, 18 states require a career preparedness performance accomplishment which can be demonstrated by earning a certificate, credential, grades in career and technical education classes, or performance on the WorkKeys exam, which tests career readiness skills. Career preparedness participation, taking CTE courses, job training, or performance on the WorkKeys assessment is accepted for ten states. The number of states with no ILP in place or that do not require career preparedness performance or participation is three and one, respectively, (see Table 2).

Postsecondary Preparation in Virginia

Virginia is an example of a state that has recently begun to place a strong emphasis on the postsecondary preparation and outcomes of its students. In connection with the heightened awareness of the critical need to strategically prepare for postsecondary careers, the Virginia legislature has recently signed into law the requirements for all graduates to receive some level of preparation for life after graduation (College and Career Readiness, 2019). According to this

recent legislation, seventh-grade students are required to begin work on an academic and career plan portfolio (ACPP) which is a collection of students' career-related investigations over time. Along the same lines of the portfolio requirement, students are required to take a career investigations course in the seventh grade (College and Career Readiness, 1997/2019). Virginia's high-school graduates are "expected to…attain and demonstrate age-appropriate productive workplace skills, qualities and behavior; align knowledge, skills and personal interests with career opportunities" (Program of Instruction and Learning Objectives, 1997/2018, para B). These enhancements to graduation requirements are indicative of the importance of students' intentional focus on post-secondary awareness and preparation.

Table 2

Graduation Accountability for Post-Secondary Preparation

	Career Preparedness Performance	Career Preparedness Participation	4-year graduation	State achievement tests
No ILP in place	3	1	7	7
ILP not mandated	3	1	10	10
ILP mandated	15	9	33	33
	21	11	50	50

(American Institute for Research, n.d.)

Currently, Virginia school districts are charged with creating the conditions appropriate for students to meet the requirements outlined in the new legislation. However, as with any curriculum, there should be some measure available to determine students' learning progress. Regarding the recently signed educational mandates:

1. Pre-assessment measures of students' ability to take on these tasks, like academic and career planning, or accessing the academic and career language used in the career investigations course are not widely available (VDOE, 2020).

2. Post-assessment measures to determine students' success with and understanding of the career investigations curriculum are not widely available (VDOE, 2020).
3. Limited instruments exist to measure a student's ability to academically access and understand the continuum of experiences required during their secondary matriculation, in other words, their career literacy (Kulcsár et al., 2020).

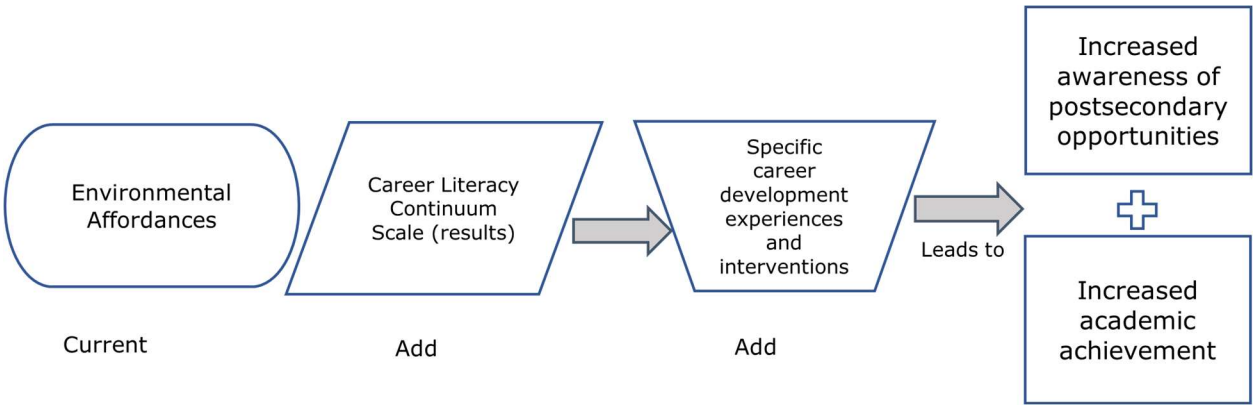
The most critical benefit of this study will be a valid and reliable instrument that provides data that may aid in improving equitable post-secondary outcomes for students. It will do this by exposing specific areas in students' career literacy that need improvement. The results will provide students, their parents, and educators with scores that place the student on a continuum of career literacy, creating an opportunity for students to receive targeted support in the needed areas. Similarly, educators and lawmakers can use the data trends to inform program and funding decisions. As an additional benefit, it will provide a rationale for the inclusion of career literacy as an important area of study for students. Finally, results from this instrument can be used to demonstrate the effectiveness of the instruction and programming developed as a result of the recent legislation.

Theory of Action

The Social Cognitive Career Theory (SCCT) provides a framework for examining the development of students' career interests, academic and future career choice actions, and how educational and career goals are formed (Lent et al., 1994). This theory examines how students' self-efficacy, goals, and outcome expectations predict and impact their career-related behavior.

Figure 1

Theory of Action: Impact of Assessing Career Literacy



The Social Cognitive Career Theory contextualizes the critical nature of career literacy as a factor for informed career choice behaviors. Environmental and person factors – parental impact, race/ethnicity, socioeconomic status, and gender – significantly impact a student's career choice behaviors. Both SCCT and career literacy highlight the impact of environmental and person factors on a student's career-related decision making (see Figure 1). However, these same factors potentially represent two different impacts. For some students, the environmental and person factors may provide barriers. Becoming career literate may negate the potential negative impacts of the person factors. Along the same lines, the results of a career literacy measurement might help a student's support system use those factors deliberately as leverage for a more positive outcome. Understanding a student's career literacy level may help school leaders advocate for instruction and services that will help students gain the experiences they need to improve their career literacy.

The main tenets of SCCT – self-efficacy, goals, and outcome expectations – are all represented as critical elements that may be positively influenced by a student's career literacy level (Lent et al., 2000). This theory of action introduces the environmental/person factors as the

primary drivers of a student's current career literacy. This study connects to SCCT in that, as career literacy increases, so will a student's career-related efficacy, and then following, development of goals and expected outcomes, as shown in Figure 1. An increase in these skills may lead to a connected increase in academic achievement, developmental opportunities, post-secondary outcomes, and ultimately, a more equitable future (Lent et al., 2000).

This study was rooted in providing a basic connection between school and its ability to provide students with the education and experiences they need to achieve any level of success to which they aspire. Given the current and forecasted outcomes for today's students, every preparation a student makes in secondary school could potentially give them a post-secondary benefit. Critical career literacy will be vital to students' ability to make good decisions in the changing career world they will encounter.

As educators look to provide increased opportunities for equitable learning, the concept of mandating students to participate in basic planning for college and careers presents a true philosophical divide. College and career preparation are ultimately focused on a pathway that promotes post-secondary studies as a prerequisite to success (Mishkind, 2014). Historically, college degrees have offered individuals more career and financial opportunities, unlike their counterparts without degrees, who could earn more than a half-million dollars less over their lifetimes (Education and lifetime earnings, 2015). However, for some students, post-secondary training is not a viable option for reasons including lack of personal interest in school or training, poor academic achievement, and the expense (Eshelman & Rottinghaus, 2015; Holland & Deluca, 2016; Plank & Jordan, 2001). While the pursuit of career literacy is appropriate for all students, there are some for which this skillset is a critical need. Students with the most critical financial needs must graduate from high school and support themselves, at the very least, and

some must also support other family members. These students must be poised to take advantage of every opportunity available during their K-12 matriculation that will give them a chance to earn more money after graduation.

In most cases, students are exposed to the opportunity to investigate career information too late, if at all (Marcionetti & Rossier, 2017). In many school districts throughout the country, students transition to high school in the 9th grade. At the peak of adolescence, students are asked to begin making choices with lifelong impacts like course selection or college majors. Without the proper background knowledge, this decision can be uninformed and made based on little, incorrect, or no data (Plank & Jordan, 2001). Just as important, students and their families can make choices from a limited perspective based only on information from their personal experiences, which could limit their options.

As with other assessments of learning, creating an assessment for career literacy will provide students, parents, most importantly, and educators with data about a student's preparation to read, understand, and make decisions about career-related information during their personal career exploration. These data provide instructors with information that prepares them to select targeted experiences, opportunities, and instruction that will help students. Students will also have more awareness of their abilities. This increased self-awareness may lead to an increase in self-efficacy (Guillon et al., 2004). By increasing self-awareness and self-efficacy, negative environmental influences may be decreased.

Limitations

The following limitations exist with the current study:

1. Although a various number of school community profiles exist, this study was limited to schools with whom I could obtain review board permission from their school district during a global pandemic.
2. Only parents who were able to read and respond to the invitation on their devices were able to provide parental consent for their students.
3. The participants were limited to those with technology and internet access at the time the instrument was administered.

Assumptions

This study was based on the following assumptions that are specific to item response theory and the participants in the current study:

1. Each item on the instrument was an indicator of and intended to measure career literacy.
2. The latent trait can be measured and was the cause of the response to each item (Devellis, 2017). In this study, the latent trait is career literacy.
3. The amount of error associated with each item varied randomly (Devellis, 2017)
4. Not all domains of career literacy need to be equally sampled by an instrument, but all items on the instrument must measure some aspect of career literacy as defined for this research.
5. Students were able to read and complete their own instrument.
6. Students who turned in permission slips for participation were representative of the school population.
7. Students had varying levels of informal career-related exposure.

8. Students all participated attentively and honestly.
9. The participating districts are representative of other school districts.
10. The career preparation of the participating students is representative of their same-aged peers.

Procedures

This study employed an instrumentation research design using a process outlined by Devellis (2017) to create the survey, and the statistical analysis of the participants' responses followed criteria found in the literature. Surveys are an effective way to gather data about attitudes and attributes. They can be collected from a significant number of participants and used to examine trends measured on specified constructs from boundless geographical locations (Patten, 1997).

Item Generation and Instrument Development Process

The researcher evaluated the literature for the knowledge and skills that were necessary for career literacy. According to Valentine & Kosloski (2021), there are 50 concepts and skills that make up career literacy. The career literacy skills were used to develop a matrix to ensure the inclusion of all of the concepts and skills (DeVellis, 2017).

Throughout its construction, this instrument's development followed an iterative process modeling the one proposed by Devellis (2017). To provide validity to the instrument, content, face, and construct validity were evaluated in an iterative process after receiving IRB approval. Face validity was based on the expert reviewers and input from a pilot study. The content validity of the instrument came from the use of literature to inform the questions and an expert panel review of the questions. In order to lend additional content validity to this instrument, an expert review panel made up of a question writing expert, a CTE director, an administrator, and a

CTE doctoral student reviewed the questions for clarity and to confirm that the questions addressed the intended skills.

After the expert panel's question review, additional evidence of the scale's validity was established by administering a pilot study to a small sample of students that mirror the characteristics of the study's target population. Selected participants were interviewed to determine more about the test experience, perceived difficulties and barriers to participation, and other ad hoc questions stemming from the responses. Changes recommended as a result of the student data were presented to the expert panel for further content review. After the researcher adjusted the items based on student feedback, the instrument was reviewed again by the expert panel. The revised instrument was administered to the field study participants. The item generation process is outlined in Table 3.

Study Administration

Hsu and Sandford (2007) indicated buy-in and potential vested interest in the research outcome as a factor for participants' continued participation. Therefore, the researcher sought field test partners who, based on their mission statement, value career and postsecondary preparation. Several schools in the southeastern United States were contacted to determine their interest in and ability to participate in the study. One school district agreed to support the study by disseminating study details to the middle and high schools in their district, who would in turn distribute the information to families in each school. In addition to the school district, the researcher contacted a program that supported students who were first in their families to go to college. The program director agreed to provide support for the field test by providing the

researcher an opportunity to share the research opportunity with parents, and time for the students to complete the CLCS during their regularly scheduled meeting time.

After realizing that the necessary sample size might not be attainable through the initial administration attempts, the researcher reached out to several CTE program advisors across the Southeast to determine other programs that might receive a mutual benefit from participating. Finally, a middle and high school research partner was located. The teachers at both the middle and high schools received incentives to provide their students with enticements to gain parental permission and subsequently participate.

Participation in the field test was open to any student, from either group, as long as they met the age criteria and had their parents' consent. Although the parental consent and study participation were done digitally for both sites, access to the instrument was handled differently for each student. The students who attended the public school received access to a link they received as a result of the completion of the parental consent form. Students attending the college preparation program received the link from the researcher after parental consent was confirmed with program staff. All students were able to complete the CLCS on a personal or school-issued electronic device.

Table 3

Item Generation, Iterative Process

Step	Party	Action
1	Expert panel	Question review, content validity index (CVI)
2	Researcher	Question revision
3	Student sample	Pilot study
4	Selected students	Feedback on questions and process
5	Researcher	Question revision as necessary
6	Expert panel	Final question review

Sample

The Career Literacy Continuum Scale (CLCS) was developed to determine the career literacy knowledge and skills possessed by adolescents. Adolescence, according to the U.S. Department of Health and Human Services (HHS, 2019), spans the age ranges of 10 – 19, therefore the sample population for this administration were students in 6th – 12th grade. The process for the field test administration is outlined in Table 4.

Table 4

Field Test Administration Process

Step	Party	Action
1	Researcher	Secure approval and make arrangements with school division
2	Researcher	Provide conference for administering teachers
3	Teacher/Program director	Provide access to parental consent form
4	Parents	Provide digital consent
5	Students	Access digital instrument, provide assent, and complete instrument

Data Analysis

The reliability of the CLCS was established throughout the data analysis process. The participant responses were used to analyze the model fit, test items, and test reliability using the Item Response Theory (IRT) model. IRT estimates the discrimination (a) and difficulty (b) of test items. It also allows researchers to determine the level of information each item, and the overall test, provides about candidates at a given level of ability (theta). Item evaluation, model fit, and test information were evaluated based on a priori thresholds, including a test specification. The process used for data analysis is outlined in Table 5.

Table 5

Study Data Analysis Process

Step	Action
1	Clean up data, prepare for use
2	Upload data
3	Model assumption analysis
4	Tests goodness of model fit (GOF)
5	Final instrument optimization

Definition of Terms

The following terms appear throughout this study. In order to establish a shared understanding of how the terms were used throughout the research, the terms are defined as:

Adolescence: The period including the ages of 11-14 for younger, and 15 -19, older. The ages usually correspond to students in 6^{th} – 12^{th} grades (U.S. Department of Health and Human Services, 2019).

Goals: "The determination to engage in a particular activity or to effect a future outcome" (Bandura, 1986).

Item characteristic curve (ICC): A graphical representation of "the probability of an item response across the range of theta" (Stover et al., 2019).

Item information function (IIF): A graphical representation of the level at which an item can distinguish between ability levels. Items with more information provide more precision and reliability (Hambleton et al., 2000).

Outcome expectations: Defined in the context of the SCCT as "personal beliefs about probable response outcomes" (Lent et al., 1994, p.83).

Post-secondary: Any time period after high-school departure, any work completed during high school that counts towards a degree.

Scale: An instrument that measures a pre-specified trait, skill, or set of traits or skills (Devellis, 2017).

Self-efficacy: The authors of the SCCT used Bandura's (1986) definition of self-efficacy, "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (p.391).

Test characteristic curve (TCC): The test characteristic curve "shows the expected total summed score on the scale for each level of theta" (Stover et al., 2019).

Test information function (TIF): Aggregate of item functions across all items that indicates where the scale has the most measurement precision (Baker, 2001).

Theta: "Latent variable being measured" (Stover et al., 2019)

Summary

Chapter 1 introduced some of the post-secondary preparation that is taking place. The recently passed legislation in Virginia, which places a new, integrated approach on the exploration of post-secondary options and planning for students beginning in middle school was discussed. Because it has been hard to locate a measure that determines what skills students have to access career-related content, it has been difficult to precisely measure a student's growth or provide interventions as necessary. The current study proposed the development and validation of an instrument to close this gap. Chapter 1 also addressed the limitations and assumptions made during this study. A brief overview of the methods and procedures precedes the definition of the key terms and the summary.

Chapter 2 of this study reviews current and relevant literature. A focus was placed on establishing a definition of career literacy in the context of the multiple literacies framework and illustrating its potential impact on students. Additionally, an examination of connected theories

and an analysis of selected instruments provided evidence towards the significance of the gap in available instruments to measure the constructs of career literacy. Finally, the chapter ends with an exploration of the purpose and benefits of using assessment in education and how item response theory works as a tool for analysis. Chapter 3 addresses the methods and procedures used to develop and test the instrument. Chapter 4 presents the findings as they relate to the research objectives. Chapter 5 is a discussion of recommendations, based on the findings, directions for future research, and a conclusion to the study.

CHAPTER II

LITERATURE REVIEW

Across the nation, increased attention has been given to the intentional preparation of students for postsecondary endeavors (American Institute for Research, n.d.). Recent legislation in Virginia requires students to develop college and career plans and participate in a career investigations curriculum during middle school is an indicator of the importance placed on preparing students for their post-secondary experiences (College and Career Readiness, 2018). Career literacy represents the set of skills needed to understand, interpret, evaluate, and make decisions related to career information (Valentine & Kosloski, 2021). Although instruments have been developed to assess career readiness, limited options have been designed to help educators and parents determine a student's level of career literacy specifically, in this context, which would indicate their ability to understand, interpret, evaluate, and make decisions related to career information (Kulcsar, 2020).

This chapter opens with a review of relevant career theories. It then provides an examination of the contextualization of the term career literacy through other literacies, the conceptualization and operationalization of career literacy, the impact of person environment factors, the current approach to career development, the potential benefit of assessment for students, and background on item response theory for test construction. A working definition of career literacy was created using other literacies. A survey of environmental factors and their contextual impact on students' career choices is considered. A survey of career development approaches in education is followed by an evaluation of measured constructs, reliability, and validity of some common career decision-making scales. It is from this evaluation that the gap in the literature is shown.

Background Career Theory

For more than 70 years, career theorists have been offering processes and methods to assist career counselors with ways to help their clients optimize happiness through their future careers. Over time, theorists have posited different foci for examining students' career choice behavior. Many theorists have focused on personality, interests, and behaviors to provide direction (Nauta, 2010; Osipow, 1990; Roe, 1957; Super, 1953). Super's theory covers a lifetime of career choices (Super, 1953); however, the most formidable career development in an individual's life takes place during childhood to late adolescence (Schoon, 2001; Tang et al., 2008; Watson & McMahon, 2005).

Super's theory

According to Super (1953), the occupational choices individuals make are based on abilities, interests, and personality traits. Super's Lifespan theory is based on the premise that as individuals grow and develop, their skills, preferences, and career interests may change. The stages are categorized developmentally by age. Changes might be influenced by environmental and educational experiences. Super's theory supports the use of assessments to inform counseling sessions but also notes flaws in counseling models that rely on matching students to careers based on inventories, especially when the scores may reflect students' lack of familiarity with work or themselves.

Holland's Theory

During their educational preparation, counselors learn the historical career theories and adapt the ones they connect with to use in their practice (Beale, 2001). The instruments counselors use to assist them in this task are primarily based on these career theories and provide them with interest and efficacy assessments, which are primarily based on Holland's theory

(Nauta, 2010). Holland's career development theory (1959) focuses on the impact of behavior and personality on career choice development. It suggested that career selection and satisfaction are based on personality traits. The use of personality and interest inventories in career counseling is often a result of this theory. Counselors are supposed to help students match their personalities to potential favorable careers. Holland's theory, long-standing in the career counseling literature, also leaves a plethora of arguments for and criticisms of its use with students (Arnold, 2004; Ireh, 2000; Osipow, 1990; Schoon, 2001; Tracey, 2001). A significant concern is its ability to assess a student's environmental factors as impacts on their career choices (Arnold, 2004).

Gottfredson's Theory of Circumscriptions and Compromise

Gottfredson's Theory of Circumscriptions and Compromise (1981) can be connected to the Social Cognitive Career Theory and examines the environmental factors that influence career choice behaviors. Several important themes emerge from her work. Chief among the themes, and in connection with this research, is the idea that in early adolescence students begin to eliminate career options based on perceived barriers (Gottfredson, 1981; Tang et al., 2008). Gender is also highlighted as a critical influence of career choices (Gottfredson, 1981). Gottfredson's (1981) theory is poignant because it highlights the idea that children begin to restrict their career options as they age. Students begin limiting their options based on gender expectations and changing perceptions such as changes in perceived prestige status, perceived level of accessibility, and the process of reconciling perceived ability and accessibility of career entry (Gottfredson, 1981). If students can learn and understand their options at an earlier age, they may stay open to a wider array of viable careers for a longer period of time (Gibbons & Shoffner, 2004).

A person's career will impact everything about the quality of their life, most especially their finances, which influences a variety of other decisions, including housing and education, for themselves and their family (Diemer et al., 2020). If young people are eliminating careers, especially careers with high earning potential, based on gender, which is largely a female phenomenon, then a problem exists (Tang et al., 2008). Educators need to find a way to help students learn to identify and eliminate barriers that stand in the way of their career pursuits (Tang et al., 2008). Examining and providing interventions will be a strong way to counteract this adolescent tendency (Bandura et al., 2001).

Social Cognitive Career Theory

Career development theories span decades, with several prominent theories recognized through the years. The career development theories primarily focus on how and why students make the choices they make related to careers and what interests and talents correlate to specific careers. Some theories, like Holland's (1959), have led to measurement tools that have been able to provide educators and students with personality and interest data that has been used to point students in the right direction for examining the careers that may be of interest (Nauta, 2010). Historically, counselors help students make career selections based on these test results (Savickas, 1994).

SCCT is among the recent additions to the study of career theory. It establishes a connection between the prominent career development theories and Bandura's Social Cognitive Theory (Lent et al., 1994). The originators of SCCT posit that its three tenets, goals, self-efficacy, and outcome expectations, are "interrelated with other person, contextual, and experiential/learning factors" (Lent et al., 1994, p.79). Each of the tenets, examined independently, are critical to a student's academic performance in school. Couple this with the

fact that students with post-secondary goals are more likely to be engaged in their schoolwork, and the ability to make career decisions becomes an academic intervention, as well as necessary preparation for postsecondary life (Burns et al., 2021).

Social Cognitive Career Theory (SCCT) is based on Bandura's Social Learning Theory (SLT) and Social Cognitive Theories (SCT) and connects a constructivist learning model to modern career development theories (Gibbons & Shoffner, 2004; Lent et al., 1994). Social Learning Theory contributes to the field of psychology and states that children learn from their environment and interactions with people (Bandura & Walters, 1977). SLT was developed further and posits that individuals learn in a variety of ways with experience, observation, and environmental factors (Bandura & Walters, 1977). Social Cognitive Career Theory is based not only on Bandura's social theories but also on modern career development models (Lent et al., 1994). SCCT is aimed at explaining how academic and career interests are developed, how choices are made, and how success is achieved. Lent et al. (1994) suggest that "people are more likely to become firmly committed to specific rather than vague goals" (p. 96). The theory also states that, "self-efficacy serves as a more influential determinant of behavior than their ability" (p.84). The main tenets involve the blending of students' self-efficacy, outcome expectations, and goals to explain their career choice behaviors (Lent, et al., 1994). Lent et al.'s work during the development of the SCCT sought to explain how self-efficacy and satisfaction are both important and motivating factors in an individual's career preparation behavior.

History of Career Literacy

The definition of literacy has been a source of controversy over the years (Lau & Yuen, 2014). The earliest and most basic definitions of literacy included the ability to read and write one's own name or the ability to write a simple sentence (Heathington, 1987). In some contexts,

literacy was described by the number of years of schooling completed or by ones' grade-level attainment (Heathington, 1987). These limited definitions of literacy do not address the complexity of the full spectrum of skills and abilities needed to navigate life independently today.

Over time, scholars have delineated several literacies that successful independent citizens need. Powell (1977) established an early definition of career literacy to provide a substructure to the definition of literacy and draw relationships to other often connected terms. The term career literate first appears in Powell's *Levels of Literacy* in a discussion about determining literacy requirements for employment, with career literate being the pinnacle of literacy in his three-level model. This model indicates career literacy as just one dimension of an individual's literacy. Powell defined career literacy in the context of its position between basic and full literacy. He argued that in order to be career literate, an individual must possess functional literacy skills which involved an ability to function in their positions with the skills and abilities they currently possess, all of which he argues is a precursor to full literacy. Using this definition, the only measurement of career literacy is the individual's success at work.

Heathington's (1987) definition of career literate connects with Powell's (1977) in that it centers around an individual's ability to complete basic work-related tasks, though she notes in her work that "current definitions of literacy, which concentrate only on materials and skills, are lacking" (p. 217). In their studies on workforce literacy, Passmore and Mohamed (1995) indicated the increasingly technologically advanced workplace as an impetus for the workforce to be more career literate. In most instances, when literature uses the term career literacy it is commonly used in the sense of Powell's interpretation. However, in the educational context, Bennet and Robertson (2015) expanded the concept to include Cook's (2002) six literacies:

basic, social, rhetorical, technological, ethical, and critical. Educators can analyze students' skills through the lens of these six literacies to ascertain a more complex profile of a student's capabilities, which might aid in the measurement of learning outcomes (Bennet & Robertson, 2015; Brumwell et al., 2017; Cook, 2002).

The Ball Foundation coined the term again as the "basic knowledge and skills that we all need to help us read the 21st century work environment" through their service arm Career Vision™, (2018) (para. 1). This definition is not significantly different than the definition posited by Powell decades ago. It also does not provide a full spectrum of career literacy, especially concerning modern definitions of literacy. The Massachusetts Institute for College and Career Readiness recognized career literacy as a framework for supporting college and career readiness with a focus similar to that of the Virginia Department of Education, making sure students have career and education plans (College and Career Readiness, 2018; Massachusetts Institute for College and Career Readiness, 2018). These attitudes represent one or more elements of career literacy, mostly grounded in the functional or basic level of literacy.

As educational systems are tasked with providing relevant and appropriate career knowledge, students' attainment of these skills must be measured as learning outcomes (Brumwell et al., 2017). To do so, an appropriate definition of the outcomes to be measured must exist. A connection between content area literacy, "skills learned from subject matter experts", and disciplinary literacy, "an emphasis on the knowledge and abilities" of those experts, must be drawn to determine what outcomes need to be measured (Shanahan & Shanahan, 2012, p.8).

Education today recognizes the significance of the multitude of literacies individuals must have to be truly literate (Cook, 2002; Doustmohammadian et al., 2017; Shanahan & Shanahan, 2012). Drawing on Powell's layered concept of literacy, several new literacies are

defined with complex, multi-layers as shown in Table 6. The definition of career literacy, for this study, was developed using the concepts behind layered literacies, to encompass students' needs to have a "complex range of knowledge and skills" (Cook, 2002, p.24) as they prepare to enter a workforce vastly different from the one envisioned with the traditional system of education (Bennett & Robertson, 2015; Cook, 2002). The layered literacies provide six areas of literacy for writing, basic, social, rhetorical, technological, ethical,, and critical, which could translate into areas of assessment (Cook, 2002).

Table 6

Existing literacy definitions

Literacy type	Definition
Health literacy	"The cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health" (Nutbeam, 1998, p.357).
Health literacy	"The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (Larsen, 2007, p. 711).
Food literacy	"Collection of interrelated knowledge, skills, and behaviors required to plan, manage, select, prepare and eat foods to meet needs and determine food intake" (Vidgen & Gallegos, 2014, p.54).
Nutrition literacy	"the ability to access, interpret, and use nutrition information" (Doustmohammadian et al., 2017, p.3)
Information and communication technology (ICT) literacy	"using digital technology, communication tools, and/or networks to access, manage, integrate, evaluate and create information to function in a knowledge society" (Lau & Yuen, 2014, p.1)

Establishing Definitions of Other Literacies

Nutbeam (1998) theorized health literacy using a complex framework that included three practical ways to view these literacy skills, using functional, interactive, and critical skills. The definition of health literacy is "the cognitive and social skills which determine the motivation

and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health" (p. 357). The definition model for information and communication technology (ICT) literacy provides a similar progression in its definition of literacy, the ability to "access, manage, integrate, evaluate and create information" (Lau & Yuen, 2014). All three definitions provide space for students to move along a continuum of learning, similar to the new Bloom's Taxonomy, which is frequently referred to in the attainment of educational learning outcomes (Dixit et al., 2021).

Doustmohammadian et al. (2017) conducted a study to develop a measure of food and nutrition literacy in youth using Nutbeam's (1998) definition of health literacy as the basis for their operational definition. Using the definition model for food and nutrition literacy presented by Doustmohammadian et al. (2017), functional [career] literacy is defined as "the basic reading and writing skills necessary to understand and follow simple [career-related] messages" (p.3). Interactive [career] literacy is "an advanced literacy which includes cognitive and interpersonal skills needed to manage [career-related] issues in partnership with professionals" (Doustmohammadian, et al., 2017, p.3). Critical career literacy represents "the ability to analyze [career-related] information critically, increase awareness, and participate in action to address barriers" (Doustmohammadian, et al., 2017, p.3). This definition model emphasizes a set of progressive skills that students should possess as they move along a continuum of literacy proficiency.

Career Literacy Conceptualized

An examination of the definitions of these literacy concepts provides an insight into the complex range of abilities that must be mastered to be considered literate in each area. The definitions provide room for learners to be able to access, process, evaluate, make decisions, and

take action as they become increasingly proficient. When considered all together, the skills depict the complexity and higher-order skills required to demonstrate career literacy, which, for the sake of this study, is defined as the set of knowledge, skills, and behaviors/abilities that students need to understand, interpret, evaluate, and make decisions related to career information (Valentine & Kosloski, 2021).

Career literacy, in the same manner as the other literacies, can be broken down into three basic concepts: interactive, and critical (Cook, 2002; Doutmohammadian et al., 2017). Functional skills include understanding vocabulary, reading text, and basic writing (Passmore and Mohamed, 1995). According to Doutmohammadian et al. (2017), interactive literacy encompasses advanced skills that indicate individuals can discuss their current knowledge with people who may help them make decisions. Finally, in alignment with Bloom's taxonomy, critical literacy is the pinnacle level of understanding, when individuals can demonstrate the ability to analyze information, make a decision, and take action (Cook, 2002; Dixit et al., 2021).

Career Literacy Concepts Operationalized

Ho and Sum (2018) used their interpretation of the literature and the analyses of the other instruments to create the CEDSIS (Career and Educational Decision Self-Efficacy Inventory for Secondary Students). Career literacy, based on the synthesis of the definitions for other literacies, is conceptualized into three categories: functional critical literacy, interactive career literacy, and critical career literacy. Each category is made up of two domains, concepts (knowledge) and skills. Using the definition for career literacy, the functional, interactive, and critical skills a student needs to interact with career-related information, Valentine and Kosloski (2021) conducted a Delphi study to develop expert consensus about the elements necessary to be considered career literate across all three categories. As a result of the Delphi study, 50

concepts/skills were identified (see Table 7). The constructs represent a continuum of knowledge or abilities. Some broad concepts are represented in more than one category (i.e., interpreting information). However, the category indicates a specific type of interaction with the concept, therefore each item should be considered separately.

Table 7

Career Literacy Concepts and Skills

Concepts		
Functional	Interactive	Critical
Adjudicate facts versus opinions	Acknowledge expertise/experience as beneficial qualities to seek in career advisors	Analyze ones' own self values, skills, apprehensions, fears, knowledge, and incompatible work settings, and how these things play a role in ones' success within a particular position
Knowledge of career options and job outlooks and how Career Clusters and Pathways are connected to career exploration	Acknowledge the importance of persistence and follow through	Analyze ones' role in a specific task or work environment
Knowledge of the elements of good teamwork, as well as the importance of working on a team	Indicate how different skill sets and predispositions relate to different career fields	Calculate the consequences of irrational long-term and career-limiting decisions
	Interpret professional etiquette expectations (communication, attire, topics, etc.), as well as how those expectations may vary from one career to another	Identify basic requirements of a job to determine whether one meets said requirements
	Knowledge of one's own past triggers, as a precursor to managing professional demeanor in a given environment	Identify the steps needed to gain the required skills toward entry into a career

	Take the initiative to seek out career information and discuss it	Immerses oneself in field experiences or similar environments to gain a better understanding of a career
	Translate career progressions and different steps within a career ladder	Self-assess with honesty and forthrightness
	Use one's own discernment, empathy, and grit in communication and goal setting	
	Utilize feedback and advice to advance one's range of career opportunities	
	View things from others' perspectives, understanding that interactions with others often have little to do with oneself and more to do with others	
	Skills	
Analyze simple and complex written instructions to perform a task	Articulate ones' own skills/values, transferable skills, and career goals	Ability to determine the overall financial cost to prepare for a career
Analyze the credibility of a source of information	Ask the "right" questions to seek answers, provide clarity, or to problem-solve	Advocate for oneself with respect to ones' career (ex. calling to schedule an interview)
Apply what has been read to real-world situations	Communicate personal career interests and discuss career opportunities with prospective employers and other influencers	Analyze an environment to address barriers to career entry
Articulate skills possessed through the completion of a resume	Communicate with experienced people with respect to a given career field	Apply written, verbal, and digital information to solve problems
Complete a job application	Contact, obtain permission, and prepare a list of professional references appropriate for a specific job opportunity	Ask questions that will expand the narrative and discussion in an organization

Decipher information presented in different forms (orally, written, visually, etc.)	Knowledge of appropriate vernacular by audience (code-switching)	Collaborate with others and be open to other's ideas
Effectively communicate orally and in writing related to work performance	Knowledge of your own bias and its impact on your assumptions and interpretations	Conduct career research to inform career decisions
Interpret information from datasets, or others graphical representations of data	Listen thoroughly, show empathy, and a genuine effort to interpret the speaker's perspective, both implicitly and explicitly	Exercise emotional intelligence and empathy
Manipulate basic math functions, exemplifying data literacy	Read, process, and interpret career information regarding employment	Match ones' own values, interests, and skills, with a compatible career
	Speak articulately and generally communicate orally in a professional manner	Relate ones' own academic/skill portfolio with desirable career paths
	Work collaboratively with diverse groups	

(Valentine & Kosloski, 2021)

Career Decision Making

Adolescence is the most significant period of time for initial career decision making (Gati & Saka, 2001; Schoon, 2001). In some cultures, career decision making is a family matter (Huang & Hsieh, 2011). Children's attitudes, including career decision making, are based on experiences (Hung-Chang & Mei-Ju, 2014). Students need to be exposed to career options at earlier ages, before they begin making post-secondary plans (Boyington, 2018). "Occupational aspirations articulated in mid adolescence are in fact very initial ideas that change over the life course" (Schoon, 2001, p.131). Both academic and non-academic experiences are important to career development (Watson & McMahon, 2005).

Efficacy

The literature indicates several reasons students experience career decision making problems: lack of efficacy, indecision, and lack of information (Gati & Saka, 2001). Generic

career programs, such as those designed for the whole school or an entire class, are not effective (Tracey, 2001). Students need to actively participate in order to make meaning of the career exploration process (Kuijpers et al., 2011). As indicated previously, parents have a significant influence on career decision-making behavior. In addition to their example as an influence, their dissonant expectations can also contribute to career decision-making difficulty (Liu et al., 2020). Historically, parents and society have placed higher expectations on boy's educational and career aspirations (Hoffman, 1977). Boys more frequently reported greater of difficulties with concerns including internal conflict, and a lack of or unreliable information. However, later in school, 11th grade, girls rather than boys reported a greater difficulty of career decision making with lack of information as the primary issue. Learning experiences are strong predictors of self-efficacy and support the idea that more experience offers the opportunity for more skill development (Lent et al., 2017).

Indecision

Career indecision is also a choice behavior, though it is unproductive (Gati & Saka, 2001). Students who feel uncomfortable or like they cannot make a decision may avoid career-related tasks (Olle & Fouad, 2015). One factor that restricts occupational choice is lack of knowledge, which forces an individual into a defacto choice, or non-choice, because they have not been able to evaluate all of the options (Blau et al., 1956). Lack of readiness, information, and inconsistent information makes career decision making difficult (Gati & Saka, 2001; Marcionetti & Rossier, 2017).

Lack of Information

Career exploration, with the unwieldy number of options available, can be overwhelming for adolescents (Olle & Fouad, 2015). Middle school counselors have multiple job duties,

including administrative tasks like scheduling, in addition to an increasing counselor to student ratio (Godbey & Gordon, 2019). However, despite efforts by school counselors, some populations are not connected to career development opportunities (Gibbons & Shoffner, 2004). This highlights a critical gap in career development services in school. More focus is needed on the learning process involved in career development (Watson & McMahon, 2005). This leads to the importance of the need to develop confidence in career decision making skills.

Environmental Barriers

Students in inner-cities are at a sharp disadvantage when it comes to career exploration because their environments have less opportunities to observe or meaningfully engage in career-related experiences (Olle & Fouad, 2015). Adolescents requiring more help and support, or who feel less supported by their parents, benefit from being identified early so that assistance can be offered to their family (Marcionetti & Rossier, 2017). The goal for educators should be to keep the career exploration window open as long as possible, through exposure, to give students the largest number of potential career options (Gibbons & Shoffner, 2004).

Contextual resources are important in overcoming career decision making difficulties (Marcionetti & Rossier, 2017). Results of analyzed career assessments and inventories should be used to guide career counseling and emphasize building and strengthening beliefs in one's capacity (Huang & Hsieh, 2011). Students who take an active role in their own development will take advantage of opportunities that are available to them (Schoon, 2001). Counselors should offer programming for students and their families to help them develop the skills necessary for success with career decision making (Gibbons & Shoffner, 2004).

Current Approaches to Mitigating Career Decision Making Problems

"Occupational choice is not a single decision, but a developmental process which takes place over a period of ten or more years" (Ireh, 2000, p.31). Most students in the United States spend an average of at least 13 years in the K-12 school setting. The school has a significant role in the preparation of youth for the workforce of tomorrow. School-based opportunities for career development are usually done at the direction of the counselors from guidance given at state and local levels (McFadden & Curry, 2018). State level guidance also indicates requirements for other curricular areas to expose and connect students to career exploration, for instance, physical education teachers might have to require a career research project in class.

Academic Approaches

Counselors as Career Development Specialists. In middle school, students have the responsibility of exploring and planning their initial high school courses. Students should be fully informed to make career-related decisions before they must make those choices. Counselors are integral to this process. According to Advance CTE & American School Counselor Association (2018), though used by only 27% of counselors, an extremely effective way middle school counselors can help is to connect students with CTE coursework and career pathways, according to 87% of school counselors who use this strategy. They also include inventories (78%) and experiences (55%) as effective strategies for middle school counselors. Additional efforts include career days, job fairs, and providing information. A lesser used strategy (23%), work-based learning, is also considered an extremely effective strategy.

Following middle school, the "main goal of school counseling is to help high school students understand the connection between their academic achievements and potential careers" (Choi, et al., 2015, p.171). High school counselors use career tools more frequently to provide

information on career pathways (78%), connect with early college opportunities (79%), conduct skill and interest inventories (70%), and work with students to plan (67%) representing the most used strategies (Advance CTE & American School Counselor Association, 2018).

While counselors have been employing effective techniques, they are not able to do so at the rate they need to in order to make a difference (Advance CTE & American School Counselor Association, 2018). In fact, most state CTE directors would rate their states' career advising practices as either somewhat or not effective or available (87%; School counselor.org), contrasting with counselors' optimistic self-rating of their effectiveness. Current academic and career plans are integral to helping students prepare for their postsecondary success. They admit that "too few learners are experiencing this type of career advising and development system" (Advance CTE & American School Counselor Association, 2018, p.4). The effective, active career counseling interventions contrast with the traditional forms of career guidance which sometimes consist of students participating in nonspecific conversations with the counselor or taking inventories, without help interpreting the results. These types of actions generally do not make a significant difference in career actions (Advance CTE & American School Counselor Association, 2018).

According to best practices for education, it is important for students to participate in activities they have self-selected (Eaton, 2020). Support for developing career competencies is best achieved by encouraging work-place experiences and assignments where students will have the chance to engage in hands-on, practical learning situations (Choi et al., 2015). This idea is echoed in Kuijpers (2011) recommendation of creating learning environments to simulate work experiences and the following up with dialog to contribute to the development of career competencies. Huang & Hsieh (2011) suggest that counselors use the results of efficacy-based

measures, such as the Career Decision Self-Efficacy scale, to offer guidance for information gathering and the opportunity to perform tasks for skill building. According to Choi et al. (2015), increasing direct interventions for students will also yield increased career skills, career maturity, and career future certainty, and as a result, greater academic success.

"Across the board, states are not overly confident in the effectiveness of their career advising and development systems" (Advance CTE & American School Counselor Association, 2018, p. 2). Part of the problem is a result of the barriers faced by counselors with heavy workloads ranking among the most significant. Traditional psychological counseling, personal growth and development, and other academic requirements interfere with school counselors' capacity to participate in career advisement activities (Beale, 2001). Other barriers exist, beyond capacity and time, such as a lack of professional development and open discussions with a more well-rounded group of stakeholders. Counselors also indicate a lack of resources and understanding as barriers. Just under half of counselors, 47%, use inventories, which are one of the most used resources for career advising (Advance CTE & American School Counselor Association, 2018).

Career-Themed Academies. The premise of a career-themed academy is to offer students their content through a particular career theme while at the same time allowing them to take introductory career-related classes. The purpose is to offer students some deeper experiences with careers than a normal career report. The career themes of the academies are based on Career Pathways. In some school districts, career academies are open to students across the district and follow less strict rules for enrollment than others. The career academies offer students, in some cases, the opportunity to gain initial licensure for some lines of work like cosmetology and emergency medical technician (EMT). In some schools and districts, students

have the chance to choose only from their schools' offerings, regardless of their interest. The flaw to this approach may lie in limited resources. Without a connection to the career academy, a student may not benefit from the exposure beyond knowing they are not interested (Guillon et al., 2004; Kuijpers et al., 2011).

Career Day. Career day activities are a common way to offer students a glimpse into various careers led by those involved in them. In preparation for career day, parents and community members are contacted to come to the school to talk to students about their jobs. The professionals who attend career day share their experiences with students in the same manner as a poster presentation. Career days that are done effectively encourage students to examine a variety of careers and ask probing questions (ACTE, 2006). These are good opportunities for students to see careers represented that extend beyond their parents' occupations. However, career days may reinforce gender roles and without a specific interest or guidance to help process their findings, it is not effective (Guillon et al., 2004).

Inventories/Assessments

Testing. Counselors offer testing opportunities to help students learn more about various aspects of their own career interests and development (McFadden & Curry, 2018). As Social Cognitive Career Theory states, students' efficacy and goals evolve over time and are influenced by several factors. When counselors test and understand their students' interests, they can possibly direct students to specific careers to explore. Offering students the chance to determine their interests is important for them to be able to narrow down their career investigations. One reason for career development inaction is the feeling of being overwhelmed by the number of choices (Olle & Fouad, 2015). Kulcsar et al. (2020) performed a meta-analysis of career theories and their resulting inventories or instruments and were able to classify the most popular ones by

concept. The instruments that fell into the information category were helpful for resolving information access issues

Digital Career Tools. Free and subscription-based tools exist to help students begin to identify career interests. Several states have created web sites to facilitate students' exploration of the Career Pathways. Naviance, an example of a paid service, is a program available to assist counselors, parents, and students to navigate the college and career exploration process (Naviance, n.d.). Included with Naviance is a full curriculum designed to assist students with essential college and career preparation for the duration of their secondary careers. Schools have the option to purchase various packages for their students. For schools who can purchase the Naviance program, it offers a streamlined way to offer career support and guidance for students. On the other hand, if students are not ready to be serious about their careers, or if there is no debrief or follow-up on the results with the counselor or others in their support system, this extensive tool may not be as helpful as it is intended (Marcionetti & Rossier, 2017).

Personal Approaches

Research. While the use of Naviance is directed by the counselor, its lessons are largely done on an independent basis or during a home room period (D. Champ, personal communication, June 7, 2020). Students with a personal interest in career exploration, or one initiated by a class assignment, have several credible places to look for information. A school or local library has multiple entry points for locating career-related information (American Association of School Librarians, 2018). As examples, one can find access to books, databases, and web sites organized by Career Pathway or other skills offered by the state. Students can look for information independently or they can enlist the librarian for help locating the desired information. Since the time of the very earliest libraries, librarians have been a community pillar

of information, and charged with helping individuals in their pursuit for career information (AASL, 2018; Kitson & Lingenfelter, 1936).

Experience/Observation. Social Cognitive Career Theory points out the impact of career self-efficacy on interests, regardless of gender, although career experiences influence the efficacy of female students more than their male counterparts (Tang et al., 2008). This suggests that many of the current methods for negating contextual affordances may be somewhat beneficial for female students. The current career outcomes point to a strong need for intervention for youth, especially women, and minority students (O'Higgins, 2017).

Volunteer. Participating in a career is one way to increase a student's career knowledge (New Initiatives for Youth, 2018). Another way that students can learn more about career options available to them is by volunteering. Volunteer experiences are usually chosen by the participating student in an area they are interested in or directed to because of their adult connections. Although different schools have different administrative requirements for student volunteers, the experience provides them the chance to recognize their comfort level with a potential career. When students volunteer, they receive hands-on experiences which "significantly influence one's self-efficacy, which then influences one's career interests and choices" (Tang et al., 2008, p.292).

Environmental "Person" Factors

Social Cognitive Career Theory recognizes how, in general, the main tenets - self-efficacy, outcome expectations, and goals - are the strongest indicators of an adolescent's career choice behaviors. Lent et al. (1994) note the importance of considering the impact of "person" variables such as parental influence, gender, socioeconomic status (SES), and other influences like race and adjudication status. The authors of the theory speculate that environmental factors

also have dynamic impacts on student career choices (Lent et al., 1994). The environmental factors can have both positive and negative impacts, and several studies have sought to outline mitigation strategies (Davis-Kean, 2005; Dubow et al., 2009; Fisher & Stafford, 1999; Wiggan, 2007). Al-Bahrani et al. (2020), after noting the impacts of environmental variables, suggested the importance of considering "contextual variables when designing intervention" (p.703).

Parental Influence

Parents are the first and most significant influence on children through early adolescence (Davis-Kean, 2005; Farkas, 2004; Olle & Fouad, 2015; Trice, 1991). Olle and Fouad (2015) and Trice (1991) indicated that the debate in literature about when, either during mid- to late-adolescence, parental influence is eclipsed by that of peers. Regardless of the specific timing of the transfer of power, parents remain strong influencers in their children's lives (Olle & Fouad, 2015). Research suggests that parents engaging in active mediation of their children's decisions foster useful bonds and positive development in adolescence (Rodríguez-de-Dios et al., 2018).

Parental education, support, and career status influence their children's career-related behavior. Parental education is a significant indicator of a student's academic achievements and outcome expectations (Davis-Kean, 2005; Dubow et al., 2009). The impact of parental education is greater for students with low socioeconomic backgrounds (Turner et al., 2019). The relationship that exists between parents' education and income is a direct indicator of academic achievement for Caucasian children, while it is indirect for African-American children (Davis-Kean, 2005).

Parental Education. Parental education, socioeconomic status, and achievement are all interconnected. The literature has been consistent about the connection between the predictive ability of parental education on children's academic achievement (Davis-Kean, 2005). Parental

education impacts academic achievement through their level of expectations of their students and by the skills present in their parenting styles (Davis-Kean, 2005; Wiggan, 2007). Wiggan (2007) surmised that parents from middle-class backgrounds are more likely to teach their children to be self-directed, while working-class families prepare their children to follow the rules. Children learn from the speech patterns practiced in their homes, which according to Farkas (2004) is limited in working-class homes and richer in middle-class families. Speech patterns are also indicative of the development of a child's vocabulary, which again, vary inversely between working-class and middle-class families (Farkas, 2004).

Dubow et al. (2009) found that parental education, especially that of the mother, was more impactful on student's achievement than the SES of the family. The father's education and occupation are more of a predictor of SES than the mother's education (Huang & Hsieh, 2011), which is a key indicator of academic achievement (Davis-Kean, 2005). In their examination, Dubow et al. (2009) drew a connection between parental education, SES, and students' achievement. As a result of the study, Dubow et al. (2009) assert that parental education is so important that, as a social policy issue, it would provide a greater impact on students' achievement than providing supplemental income alone (Davis-Kean, 2005).

Parental Career Expectations. "Career expectations influence an individual's career fulfillment" (Hung-Chang & Mei-Ju, 2014). A parent's occupational choice ultimately leads to the choices available to their children (Blau et al., 1956). The main contextual affordances that impact a student's career choice behaviors are their family situation (parents), race/ethnicity, gender, resource availability, and barriers (Lent et al., 2000). Parents, or the adults with whom a student primarily resides, provide the most significant influences on a student's career choice behaviors. Parents, by establishing the home location, choose the school and other neighborhood

resources available to their family. Race, resource availability, and youth status could all be considered barriers to full career awareness and resulting behaviors (Diemer et al., 2020). Resources, including human capital, are indicators of the types of opportunities and access students can expect.

Parents influence career aspirations and career aspirations lead to career-related outcome expectations. Parental support is a more significant predictor of outcome expectations and career decision making (Marcionetti & Rossier, 2017), than it is for self-efficacy (Davis-Kean, 2005; Turner et al., 2019). The mother's support was key to being prepared to deal with career-related behaviors (Turner et al., 2019). Parents' careers are highly related with children's career aspirations (Hung-Chang & Mei-Ju, 2014). In fact, 40 % of childhood career aspirations match the father's occupation (Trice, 1991).

Gender

Gender is responsible for part of the way students interact with and interpret the information cues around them (Turner et al., 2019). Students are more likely to take an interest in traditional gender-based careers (Foldesy & Foldesy, 1993; Turner et al., 2019; Watson & McMahon, 2005). However, girls from privileged backgrounds or with higher GPA's are more open to atypical job aspirations (Al-Bahrani et al., 2020; Schoon, 2001). According to the International Labor Organization data on youth labor market access, almost one-third, 30%, of young women worldwide are jobless and not in education or employment training (NEET). In comparison, 13% of young men are NEET, a considerable number since positions for youth are in a decline (Gammarano, 2019).

Women experience careers, after selection, differently than their male counterparts. Women perceive significantly more career barriers than their male counterparts (Gnilka &

Novakovic, 2017), which could be one explanation for their underrepresentation in many STEM careers (Turner et al., 2019). The lack of women in the STEM fields is not necessarily indicative of their academic success in those courses (Turner et al., 2019). Some of the barriers that exist like the internal conflict between career and motherhood, influence the career choices made by women, and even eliminate some careers from consideration. Latina students have higher academic achievement and outcomes than their male counterparts; however, rather than barriers, acculturation and the economic value of education are introduced as other potential factors that mitigate career outcome expectations (Colón & Sánchez, 2010).

The gap in pay that favors men over women has been noted throughout recent history (OECD, 2019; Foldesy & Foldesy, 1993). College educated women earn 71 percent of their male peers' salary (OECD, 2019). Educational policymakers have developed regulations to swing the pendulum in a more centered direction. An emphasis has been placed on providing more adequate funding and directly recruiting women and girls to participate in activities that have traditionally been male dominated (Gnilka & Novakovic, 2017; Turner et al., 2019). Men pursue STEM in higher education at a significantly higher rate than women, 34 and 14 percent respectively. Careers in science, technology, engineering, and math remain the highest paying, by at least twice as much, and male-dominated industries, although a great deal of targeted effort has been put forth to attract girls to these activities and programs. Despite this push, girls are still less likely to engage in non-traditional career roles and instead, continue to prepare for more service-oriented jobs, like education ,which are the lowest paid and may factor into the pay gap (OECD, 2019).

Socioeconomic Status

Poverty Status. In addition to parental education, multiple studies have connected family SES to academic achievement (Davis-Kean, 2005; Dubow et al., 2009). Wiggan (2007) plainly describes the important impact of the circumstances a child consistently endures as a result of their home life. Primarily because it is constant, and children have limited impact on their family's financial situation or the resulting access to resources. In his assessment of the state of educational inequality, Wiggan (2007) also observed that the status of schools in impoverished neighborhoods perpetuate the status quo. The resource limitation and often teacher expectations both serve to limit the potential of students educated in poor schools (Wiggan, 2007).

"Children living in poverty have restricted occupational aspirations and occupational knowledge" (Weinger, 1998, p.123). Socioeconomic status has proven to be an indicator of entry, or non-entry, into STEM-related fields (Turner et al., 2019). The opportunities available by school are also dictated by resources which, in most cases, are fundamentally impacted by the SES of the surrounding neighborhood. The cycle of barriers and opportunities, or lack thereof, will continue for students until something breaks the pattern.

Other Barriers

"Interests turn into occupational choices when an individual perceives few or no barriers to success in that occupation" (Gibbons & Shoffner, 2004, p.94). "In SCCT, barriers generally refers to negative contextual influences" (Lent et al., 2000, p.39); however those same person-factor barriers, in a different circumstance, could have a positive effect on success (Gibbons & Shoffner, 2004). Just like not all outcome expectations are positive, not all negative contextual affordances, or barriers, will negatively influence career choice behaviors. Some students do succeed despite their circumstances.

Various students, both male and female, high school and college, regardless of racial background, perceive barriers to their future career choices (Lent et al., 2000). Among those with the most significant barriers to career exploration are adjudicated youth. Youth who have been released from the custody of the judicial system need access to career counseling, including access to practical, hands-on experiences, even more critically than some other marginalized youth (Bartlett & Domene, 2015).

Race/Ethnicity. African American and Hispanic students are reported to have lower academic achievement than their White counterparts (Holland & DeLuca, 2016). For example, in a study of Latinx youth, acculturation and economic value of education play a pivotal role in their academic achievement (Colón & Sánchez, 2010). The results of their study posits the increased economic value female students place on education is a motivator for better grades. This connection seems to represent an example of the interplay between self-efficacy and outcome expectations as expressed in the SCCT.

Teacher Expectations. Teachers expectations, especially low ones, have a significant negative influence on students' self-efficacy, especially African American and Latinx students (Fisher & Stafford, 1999). Wiggan (2007) also highlighted the connection between the low teacher expectations and high poverty schools. Simply put, it has been common practice, historically, to teach African American or other minority students less because lower academic capacity was assumed (Gordon, 2014; Wiggan, 2007). Without the opportunity for stimulating and challenging instruction, students do not have the opportunity to learn and grow academically. The influence of the environmental variables has been measured over time, though generally from a deficit model. Most literature has focused on what children in high poverty environments have lost or where they fall short.

Assessments & Intervention

Assessment keeps people accountable to the greater governing body (National Council of Teachers of English Working Group, 2020). Educators use assessments to determine where students are academically and are able to subsequently provide them with the appropriate instruction to reach their academic goals (Brumwell et al., 2017). As a result of diagnostic assessments educators are able to make important decisions about strategies and supports that help students increase their ability in the concept being measured (Childress et al., 2020).

Data-Driven Decision Making

The National Council of Teachers of English (NCTE) offers a position statement on the assessment of literacy. They were tasked, as an original authority, to determine not only the definition for literacy, but also the requirements for the measurement of literacy readiness. According to the NCTE, literacy assessment helps educational stakeholders focus on realizing where students are and how to help them improve (National Council of Teachers of English Working Committee, 2020). In education, assessments are used to determine how students are performing in relationship to expectations. “Evaluating the affective conditions of individual students can only lead to a better understanding of students’ needs, inform instruction, and guide students to establish personal self-concepts, values, and goals” (Voorhees et al., 2007, p.33). Educators use assessment data to create revised educational strategies and interventions when students are not making the appropriate gains (Brumwell et al., 2017).

When students take well-designed assessments, their teachers can use the data to offer experiences or interventions either as a whole group or for a specific individual. Students should learn about, monitor, and assess their own literacy levels; therefore, analyses need to be helpful to the learner in addition to their teachers (National Council of Teachers of English Working

Committee, 2018). Literacy assessment requires more than learning about skills and cognitive tasks. It also includes one's efficacy, behaviors, beliefs, and perceptions. Literacy assessment includes "multiple measures of different domains" (National Council of Teachers of English Working Committee, 2018, p.3).

Some assessments have come under scrutinization because they were biased toward some lived experiences. For example, some standardized tests have historically been proven to be culturally insensitive (Kim & Zabelina, 2015; Fleming, 2000). The design principles for assessments are similar to those established to design valid and reliable instruments. The audience for the assessment is key to its development (Benson & Clark, 1982). As career investigations begin in childhood, so does a student's career knowledge development. Since we "begin developing these skills early in life, so we can look to the ways transferable outcomes are assessed in early learning, … secondary school" (Brumwell et al., 2017, p.18).

Current Career Development Measurement Highlights

Career development theorists present explanations about the factors impacting students' future occupational choices, especially their physiological development and related experiences. Lent et al. (1994) analyzed career theories based on Social Cognitive Theory when they created SCCT. Self-efficacy, outcome expectations, and choosing goals resounded as the most interconnected variables of career development through their analysis (Lent, et al., 1994). The Career Decision Efficacy Scale – Short Form (CDES-SF) has been widely used to determine students' career related self-efficacy (Ho & Sum, 2018). The original, longer version was established in the 1980s to measure efficacy in the area of career choice competencies (Taylor & Betz, 1983). The five named competencies, goal selection, occupational information, self-

appraisal, planning and problem-solving, are still measured in the short-form through half the number of questions and Likert-type scale response options (Betz et al., 2005).

Career Decision Efficacy Scale (CDES)

Makransky et al. (2015), in their discussion on the CDES, note the importance of career decision self-efficacy in terms of the philosophy expressed through Social Cognitive Career Theory (SCCT) because efficacy is a better predictor of behavior than a person's capabilities. They sought to validate the scale, an exercise undertaken by several previous researchers, for the purpose of determining if the scale could be used as a one-factor model that would combine all five scales. Additionally, they intended to analyze the measurement invariance across differing demographic variables of the scale to determine if there were patterns of variance based on specific participant characteristics (Makransky et al., 2015).

The Career Decision Efficacy Scale – Short Form (CDES-SF) highlights recent research done in the field of career decision making. The five factors highlighted in the CDES-SF provide researchers with a way to know and make connections between students' efficacy in the area of career decision making; however, Makransky et al. (2015) points out that efficacy is measured because of the perceived difficulty in measuring a student's actual ability in a research setting. Since the development of SCCT, other researchers have taken the sentiment of the interconnectedness of the various career theories and developed measurements for other aspects of the theory, focusing primarily on self-efficacy.

Career and Educational Decision Self-Efficacy Inventory for Secondary Students.

A recent study and instrument to note is the Career and Educational Decision Self-Efficacy Inventory for Secondary Students (CEDSIS; Ho & Sum, 2018). Ho & Sum (2018) position their measurement tool alongside the SCCT in that this constructivist theory provides

room for students and their learning to be fluid with individuals' characteristics and choices changing over time rather than static. This instrument study is indicative of a student's belief in their ability to do certain career related activities (see Table 8).

Table 8

Sample of Items from the CEDIS

About future study	About future career
I am able to find information from different sources (e.g. internet, or professionals) about the post-secondary programs I am interested in.	I am able to find information from different sources (e.g. internet or professional) about the occupations I am interested in.
I am able to describe the entrance requirements of a post-secondary program I might like to enter.	I am able to describe the skills needed of a career I might like to enter.
I am able to find the education and career pathways upon completion of a post-secondary program I might like to enter.	I am able to find out the average salary of an occupation.
I am able to choose a post-secondary program that will fit my ability.	I am able to choose a career that will fit my ability.
I am able to choose a post-secondary program that will fit my interests.	I am able to choose a career that will fit my interests.
<u>About future planning</u>	
I am able to make a plan of my educational and career goals for the next three years.	I am able to decide what I value most when setting my educational and career goals.
I am able to decide what educational level I will need to achieve my career goals.	

Note *Adapted from the Career and Educational Decision Self-Efficacy Inventory for Secondary Students (Ho & Sum, 2018).

The CEDSIS, based on the initial validation, has a strong internal consistency ($\alpha = .92$) for the scale as a whole and the measurement invariance between genders males ($\alpha = .91$) and females ($\alpha = .92$; Ho & Sum, 2018). Ho and Sum (2018) attempted to create a scale with a

stronger stability than the CDSES or its short-form and one that also offers a balance between educational and career aspects of career decision making efficacy. During its creation, the authors selected items that balanced theory and practicality. According to their own limitation analysis, the number of items selected for the scale may have limited its ability to measure the connection between concepts like career-indecision and vocational identity (Ho & Sum, 2018).

As they developed the CEDSIS, Ho & Sum (2018) reviewed several other scales that measured similar concepts all connected to the SCCT principal of career decision making efficacy. The Middle School – Career Decision Making Self-Efficacy Scale (MS-CDMSES), a simpler and shorter version of the (CDSES), was adapted for the developmental needs of a middle school student (Fouad, et al., 1997). The Career Development-Self-Efficacy Inventory was created to assess career-related efficacy specific to students in Hong Kong (Yuen, et al., 2005). Both scales have acceptable and high reliability, respectively (Ho & Sum, 2018). Seven items from the MS-CDMSES represented the basis of eleven items on the CEDSIS between both the "about future study" and "about future career" sections (Ho & Sum, 2018).

The items on the CEDSIS offer educators data about a student's ability to access career-related information. The results of the analysis of this scale, however, would not provide an analysis of a student's ability to understand or interpret the information they received. The scale asks for students' beliefs of their own ability to find, describe, and choose specific career-related information.

Item Response Theory

Classical Test Theory (CTT) is an established method of providing psychometric evaluations of instruments (Crocker & Algina, 1986). It provides a method of analysis that is "simple to use and require[s] little mathematical knowledge" (Champlain, 2010, p. 112). It is

useful for assessing item difficulty and discrimination. However, with its benefits come some limitations, not all of which include:

1. The statistics are sample-dependent, which limits generalization to individuals with skill levels different than the initial group (Champlain, 2010; Crocker & Algina, 1986).
2. It assumes that all scores include the same level of measurement error (Champlain, 2010; Orlando & Thissen, 2000).

Item response theory (IRT), also known as modern test theory, is another method for analyzing the psychometric properties of a test (Crocker & Algina, 1986; Devellis, 2017; Hambleton et al., 2000), and provides data about the discrimination and difficulty at the item- and test- level. The item information available through the IRT analyses is considered so precise that it is used to create computer adaptive tests that are nationally used as college entrance criteria. It is considered the preferred method for psychometric evaluations of new instruments by national standardized test makers like The College Board and the Educational Testing Service who create the SAT and GRE, respectively (Embretson & Reise, 2000; Fries et al., 2005; Lord, 1980).

IRT models assume unidimensionality, local independence, and monotonicity. A unidimensional instrument measures only one dominant latent trait. Items must be independent of each other to have local independence. Finally, the condition of monotonicity means that the increased likelihood of a correct response is due to the increased level of the trait (Claro et al, 2015; Cudeck & Henley, 1991; Hambleton & Swaminathan, 1985).

Unidimensionality

Factor analysis (FA) is normally used to estimate the structure, also called dimensionality, of a scale. Binary items, such as those resulting from a multiple-choice test, are

scored as correct or incorrect. The two possible choices indicate the dichotomous nature of the scale. However, continuous variables are required for FA which is problematic for dichotomously structured measures. In order to use factor analysis to determine the structure of a multiple-choice test with only one specific answer, a tetrachoric correlation analysis is run to create a matrix from which the factor analysis can be run (Knoll & Houts, 2012). Unidimensionality is confirmed when the "eigenvalues reveal a dominant first factor" or if "the first factor accounts for at least 20% of the variability" (Hambleton et al., 2000, p. 568).

Local Independence

The requirement for local independence is met when the probability of answering one item correctly is not based on the answer to any other item. One common concern with test construction is its length, which is controversial, with some experts arguing for more items and others arguing for the shortest test with the most information. Locally dependent items are redundant and no additional information about the candidate is added (Chen & Thissen, 1997). Additionally, a violation of local dependence can result in a distortion of parameter estimates (Sireci et al., 1991; Yen, 1993). Local independence can be measured by evaluating the X^2 and/or the likelihood ratio test (Chen & Thissen, 1997). However, it can also be assumed by a unidimensional nature of the scale, although the inverse is not true (Paek & Cole, 2020; Warm, 1978).

Model Selection

As stated previously, unidimensionality must be assumed in order to perform estimations using the item response theory analysis. Several unidimensional IRT models (UIRT) exist for estimating test responses. The one-parameter logistic model (1PL), two-parameter logistic model (2PL), and the three-parameter logistic model (3PL) are the three models primarily used to

analyze dichotomous (binary) data. The 1PL model, also co-considered as a Rasch model, describes results in terms of only one parameter, the item's difficulty (b), by holding the discrimination (a) steady (Embretson & Diehl, 2004). The 2PL model reports two parameters, item discrimination and item difficulty which provides an estimation of the item's performance at various difficulty levels (Edelen & Reeve, 2007). The 3PL model includes a parameter for guessing in addition to difficulty and discrimination (Hambleton et al., 2000). As compared to the 2PL model, the 3PL models have less desirable statistical results (Sinharay & Haberman, 2020). Support for using the 3PL model comes from its intended audience. The 3PL model is "mainly used in the educational setting, where it is reasonable to assume that students try to guess the correct answer, especially when their ability is low" (Bartolucci et al., 2015, p.78).

Goodness of Fit (GOF)

Goodness of fit statistics examine model-data fit and provide validity to the model and the interpretation of results (Mckinley & Mills, 1985). They "quantify the discrepancy between observed and expected values for model-data fit" (Maydeu-Olivares, 2013, p.71). Goodness of fit analysis and model selection should be done in tandem (Maydeu-Olivares, 2013). One way to assess and describe model fit is to compare more than one model (Bichi et al., 2016). Classical test theory, item response theory, and other scale development procedures consider the analysis of several statistical tests (indices) evaluated in connection with each other, to determine how well a model fits (Worthington & Whittaker, 2006). Each index provides different information to be used for the model-data fit assessment. The indices used should be based on the researcher's needs and should be established a priori (Huang, 2017; Mckinley & Mills, 1985).

Tests of Model Fit

Although likelihood functions can be used as part of a model fit assessment, using likelihood alone is not advised because it is known to select models with more parameters than necessary (Gelfand & Dey, 1994). The Akaike Information Criterion (AIC) is one potential measure of model fit. Measuring the closeness between a proposed model and the true model (Akaike, 1974; Burnham & Anderson, 2003), it selects the model that minimizes estimation errors though it maximizes risk (Akaike, 1974). Another estimation measure is the Bayesian Information Criterion (BIC; Schwarz, 1978). It struggles to select correct models, though that problem is corrected as the sample size increases (Vrieze, 2012). According to Yang (2005), "the virtues of AIC and BIC are quite different and, in some aspects, impossible to reconcile" (p.231). Therefore, Vrieze (2012) recommends both the AIC and BIC to examine parameter estimation.

Analysis of Model Fit

An analysis of model fit incorporates statistics seen in other factor analysis or structural equation modeling. Immekus et al. (2019) and Stover et al. (2019) use lower numbers in the AIC, BIC, and root mean square error analysis (RMSEA) as guidelines for recommending the best model. In addition to the general model parameter evaluation tests, McKinley and Mills (1985) note the likelihood ratio chi-square (X^2) test as the least problematic. They argue that it is in line with the most traditional approach, presents the fewest erroneous rejections, and can be applied to any IRT model, unlike some other approaches. Maydeu-Olivares (2013) recommends the use of the standard root mean square residual analysis (SRMSR) ≤ 0.05 as a goodness of fit index that "indicates a substantively negligible amount of misfit". Table 9 outlines a summary of the statistical tests examined for model fit and their interpretation guidelines.

Table 9

Model Fit Analysis Criteria

Test	Interpretation	Citation
Akaike Information Criterion (AIC)	Lower fit is best fit	Akaike, 1974
Bayesian Information Criterion (BIC)	Lower fit is best fit	Schwarz, 1978
Root Mean Square Error Analysis (RMSEA)	≤ 0.08	Maydeu-Olivares, 2013
Likelihood ratio chi-square (X^2)	$p > 0.05$, good fit	McKinley & Mills, 1985
Standard Root Mean Square Residual (SRMSR)	≤ 0.05, good fit	Maydeu-Olivares, 2013

Analyzing Item Response Theory Data

The estimation reports are presented as data tables and graphics. The tables provide results for the discrimination parameter (a) and the difficulty parameter (b) at the item level. It becomes difficult to ascertain the overall item and test discrimination with longer tests because tables could span multiple pages. The graphs give a visual representation of the item and test data, which makes it easier to understand the results in the context of their relationship to each other (Champlain, 2010).

Item Level Data

The item characteristic curve (ICC) in IRT is based on the model's estimation and graphically presents the probability of answering correctly based on ability (theta; Baker, 2001; Hambleton et al., 2000). Item difficulty has different meanings depending on the type of analysis. In classical test theory (CTT), difficulty represents the frequency of item choice (Crocker & Algina, 1986). In IRT estimation, the item's difficulty parameter (b) the specific location on the x-axis (theta) where the probability of a correct answer is 1. In other words, the item difficulty index indicates the specific point at which an individual's ability falls on the

continuum of easy to difficult (Baker, 2001; Knoll & Houts, 2012; Marianti et al, 2021). The item-, and subsequently, test-difficulty is used to describe the ability level of the examinee. An item with a lower score is easier than an item with a higher score (Suruchi & Rana, 2012). The item information function (IIF) "shows the contribution of particular items to the assessment of ability" (Hambleton et al., 2000, p. 571).

Test Level Data

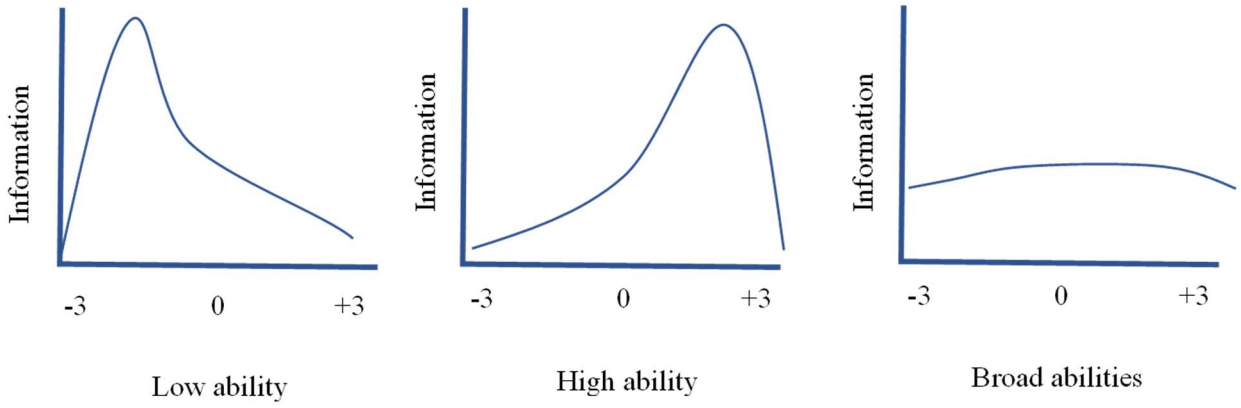
Among the chief benefits of IRT over CTT is its ability to provide specific information about the items' and tests' precision to predict an individual's ability on the latent trait (Baker, 2001). The item-level information is aggregated to become the collective test information function. Averaging item data for an entire test would not be helpful for test development because different items inherently have different values; however, "the test information function can be summarized into a single number, known as marginal reliability which has an interpretation similar to the CTT measure of coefficient α" (Knoll & Houts, 2012, p. 400). Test information function (TIF) data are used to give the test developer information about the level of information the test is providing at specified ability levels (Embretson & Diehl, 2004). The peak of the TIF is the point where the test most accurately discriminates between users' abilities.

The purpose of the test guides the analysis of TIF results. Tests intended to measure extreme candidates, for example low ability or high ability, appear differently than those intended to measure ability in a broad range (Baker, 2001; Champlain, 2010; Raykov & Marcoulides, 2018). The amount of information below the curve indicates the amount of information at specific points. In other words, a graph that peaks at -1 visually depicts an item or test that provides the most information at that ability level. For a licensing exam where it is assumed that candidates will have prepared and have high ability levels, it would be appropriate

to look for steep curves, representing strong discrimination, at a high ability level, closer to the highest values. A diagnostic test for intervention planning would have a steep curve in the low ability range which would be represented by a low TIF number. Even though IRT can be used to discriminate at polar ability levels, it is appropriate for some tests to measure a varied set of abilities. These curves are smooth (Raykov & Marcoulides, 2018). Figure 2 depicts example test information functions and their general interpretation.

Figure 2

Test Information Function Interpretation



Test Development with Item Response Theory

The goal of test development using IRT is to develop a test that most reliably meets the needs of the test author. According to Stover et al. (2019), IRT is "a flexible tool" that provides item- and test-level data while overcoming some of the shortfalls of classical test theory. The estimation data provides information about individual items and the entire test in the context of ability measurements. One proposed method of test construction, as outlined by Hambleton et al. (2000), is to pre-select a TIF level or shape at a specific ability level, compute information for each item at different ability levels, and choose items that contribute the most information.

Conflict exists in the literature as others note the importance of including a variety of item difficulties at the risk of lowering the test information (Baker, 2001; Wright & Stone, 1979).

Across the literature the item selection criteria are similar, though the specific choices are often left to the test maker (McKinley & Mills, 1985). Therefore, it is critical to involve content experts in the development process. Content experts can offer discerning opinions about item selection, especially when it does not perform well (Bichi et al., 2016; Stover et al., 2019). Common item selection criteria, or considerations for inclusion or exclusion, include high discrimination, high item function, location properties (ability levels), and high reliability (Bann et al., 2012; Benson & Clark, 1982; Hambleton et al., 2000; Ebesutani et al., 2012).

Instrument Reliability with Item Response Theory

Reliability refers to the instrument's consistency of performance. Both CTT and IRT provide a measure of reliability. Instead of using specific cut-off scores, however, test-makers using item response theory holistically view the test to determine how well it meets its intended purpose. Therefore, the researcher must intentionally identify the intended audience, constructs measured, and any other desired specifications such as time and length of the test before estimation (Baker, 2001; Raykov & Marcoulides, 2018). Test items can be evaluated for selection, based on the prespecified criteria. The evaluation is then made using item and test information. When evaluations and revisions are done well, the selected items on the test will yield thresholds of accuracy related to ability level (Edelen & Reeve, 2007).

Tests of Reliability. Post IRT estimation, statistical tests can provide reliability for the instrument. The Kuder-Richardson formula (KR20) is a well-known formula for estimating the internal consistency of items for dichotomous items (Crocker & Algina, 1986). Acceptability is indicated by values greater than 0.70 with good reliability being established at points ≥ 0.80

(Benson & Clark, 1982). The test information function provides a statistical and graphical representation of the items on the test (Raykov & Marcoulides, 2018). Its curve depicts the amount of information the test gives for test-takers at given ability levels. A reliable test intending to measure a broad range of abilities will have an information score that is similar across all abilities. Graphically, the curve is free from tight curves (Baker, 2001). In the IRT model, "the test information function can be summarized into a number known as marginal reliability which has an interpretation similar to the coefficient alpha" (Knoll & Houts, 2012, p.400). All of the reliability data should be considered in the final test construction.

Summary

This review of literature established a framework for the definition of career literacy. Career literacy was broadly defined as a student's ability to read, understand, interpret and discuss career-related information. The definition was synthesized from the definitions of other literacies. The impact of environmental person factors on career decision making were reviewed. Career decision making was discussed in the context of the current approaches being taken.

The second half of the literature focused on strategies that have been taken to improve students' career choice behaviors. Of the strategies addressed, several instruments aimed at assessing career decision making were highlighted. It was observed that the majority of instruments used to support career development are self-reported. Assessment data, from valid and reliable instruments, support instruction and intervention. Item response theory is presented as one way to measure the psychometric properties of an instrument. The next chapter presents the methods and procedures used for developing the scale that measures a student's career literacy.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to develop a reliable and valid instrument that measures students' career literacy along a continuum. This chapter describes the methods and procedures used to conduct the study. The design of an instrumentation research study is intended to provide evidence of the method used to develop and evaluate the validity and reliability of the Career Literacy Continuum Scale.

The Career Literacy Continuum Scale was developed using the process outlined by Devellis (2017). The initial items were developed based on a set of skills indicated by consensus from subject matter experts in a Delphi study (Valentine & Kosloski, 2021). Their study outlined 50 concepts that make up career literacy. A test matrix was created to inspect the balance of concepts covered through test items on the original version of the test. See Table 3 for the item-generation process.

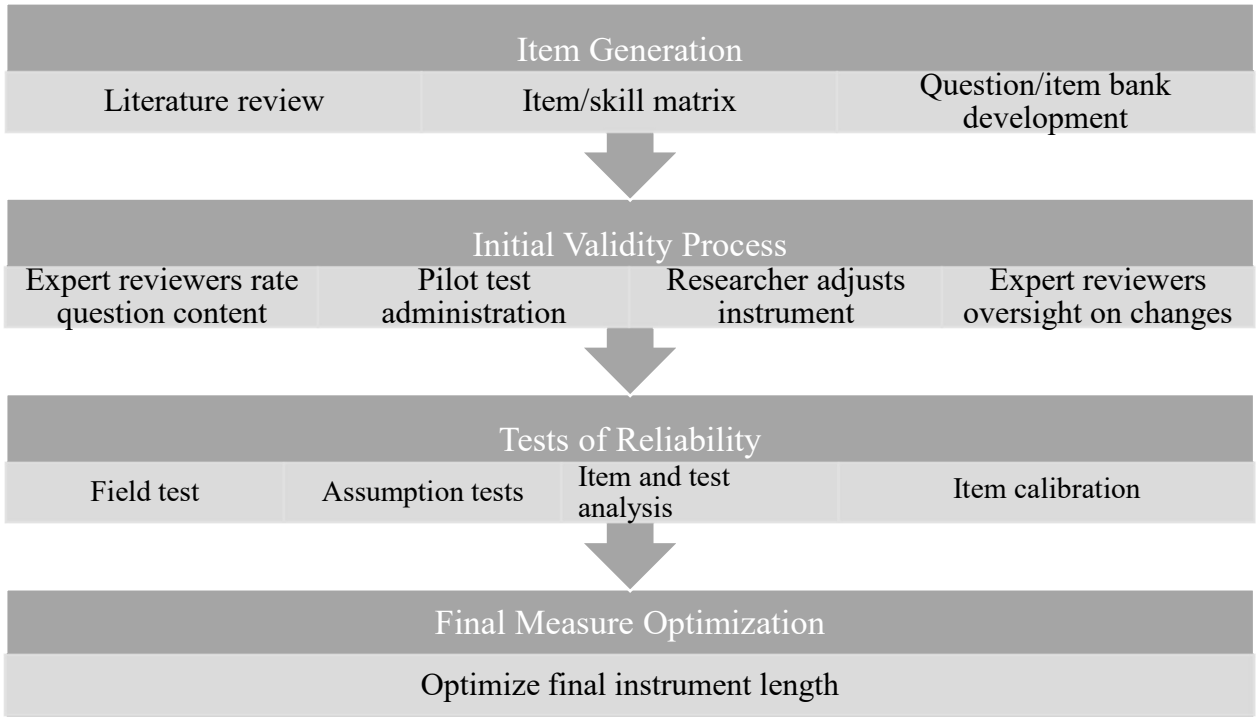
All the responses from the electronic survey platform were imported into MS Excel for preparation and then Stata for analysis. In order to analyze the collected data to determine the best model, validity, and reliability of the scale, an IRT estimation was conducted. A tetrachoric matrix of the responses was developed from the item responses in preparation for the exploratory and confirmatory factor analysis (EFA; CFA). An exploratory factor analysis was conducted to prove unidimensionality by establishing the factor structure. A confirmatory factor analysis (CFA) was conducted to confirm the unidimensionality of the CLCS and its fitness to be used for unidimensional item response theory estimations. The results of the tests were analyzed collectively using the a priori criteria established to determine if more than one factor represented the data. Following the unidimensionality and local dependency test an IRT

estimation was run for 1-, 2-, and 3-parameter models. The best model fit was selected by comparing available data. Item selection and test construction were then completed and analyzed.

This chapter includes the process for constructing the instrument and data analysis procedures for each research objective using field test observations. It follows the process beginning with item generation and continues through the establishment of validity, model fit, reliability, and the presentation of the instrument's final properties. See Figure 3 for a visual outline of the process.

Figure 3

Career Literacy Continuum Scale development process



Research Objectives

The purpose of this study was to develop a reliable and valid instrument that measures students' career literacy. For the purpose of this study, the new scale will be called the Career Literacy Continuum Scale. The research goal and objectives of this study were:

Research Goal: Create a valid, reliable measure of adolescents' career literacy.

RO_1: Demonstrate validity of the Career Literacy Continuum Scale.

RO_2: Determine the best fitting model for the Career Literacy Continuum Scale.

RO_3: Demonstrate reliability of the Career Literacy Continuum Scale.

Instrument Development

This section discusses the stages of the instrument's development in the order the process took place, with some steps outlined in more detail to create ease in study replication. The stages of the process included identifying the concepts and skills to be measured, developing the item pool, review by experts, administration of a pilot study, revision and deletion of items, field study administration, and data analysis and evaluation.

An instrument is considered valid when it can measure the phenomenon being observed which can be evidenced in several ways (Devellis, 2017; Viswanathan, 2005). In order to provide validity to the CLCS, evidence was collected to support face, content, and overall construct validity after receiving IRB approval. Face validity was established based on the expert reviewers' analyses and input from a pilot student development sample. In order to lend content validity to this instrument, an expert review panel consisting of a workforce education faculty member and program director, a K -12 school district work-based learning program leader, and a doctoral candidate studying career and technical education with experience as a collegiate summer program counselor, were asked to review the questions for clarity and to confirm that

the questions addressed the intended skills. The question writing expert held a Ph.D. in a field closely related to educational measurement. Content validity also comes from the use of literature to inform the construct and instrumentation (Boyaci & Atalay, 2016) and the inclusion of item and scale content validity indices (CVI) to provide an objective measure of agreement among the experts.

Knowledge and Skills to be Measured

As defined in this study, career literacy represents a complex aggregation of skills and knowledge using the framework of disciplinary literacies and publicly available options are limited. Kulcsár et al. (2020) collected and analyzed the most relevant career studies. Those studies do not appear to measure career literacy skills and concepts objectively; instead, they are self-reported measures. The literature offers expert judgment as a way to develop the construct being measured (Crocker & Algina, 1986; Netemeyer et al., 2003, Okoli & Pawlowski, 2004). Valentine and Kosloski (2021) conducted a Delphi study resulting in 50 concepts and skills, the basis of this instrument, that students need to be considered career literate. A Delphi study is an acceptably sound research method to define the constructs that should be measured (Okoli & Pawlowski, 2004). A Delphi study is one way to develop consensus on a topic among experts, especially when it would be otherwise impossible to connect all professionals in one place. Additionally, the Delphi method prevents the influence of any one person or idea from dominating the group's thinking, which balances the voices in the study (Geist, 2010; Hsu & Sandford, 2007).

Expert Review for Scale Validity

An expert review of the scale was conducted at various phases during the initial item generation and instrument development to add validity to the scale (see Table 3). The use of

experts to evaluate content is one way to increase the face validity of a scale (Boyaci & Atalay, 2016; Devellis, 2017; Viswanathan, 2005). The expert reviewers for this study consisted of a university faculty member (Ph.D.), a doctoral candidate with experience teaching K-12 and providing counseling in a summer college preparation program, both with a concentration in workforce education, and a K -12 district-level work-based learning specialist. These credentials offer both positional and educational indicators of their qualification to critically evaluate items (Hsu & Sandford, 2007; Sullivan, 2011).

In order to assess the content validity of the instrument, an item-content validity index (I-CVI) was established for each item, in addition to an overall scale content validity index (S-CVI), based on the experts' reviews (Devellis, 2017; Doustmohammadian et al., 2017; Polit & Beck, 2006). Career literacy and the corresponding skill list were defined and explained for the expert's understanding. The items were presented electronically. The experts were asked to rate each item for content relevancy. The relevancy was measured using a 4-point Likert-type scale, to avoid a mid-point, with 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = highly relevant. Using the process outlined by Polit & Beck (2006) for measuring I-CVI, the I-CVI was calculated by adding the number of responses for each item scoring 3 or 4 and dividing by the number of panelists. A score of 1 is considered strong for three reviewers, with scores below .80 indicating rejection. Items not meeting these criteria were to be revised or deleted. The S-CVI was calculated by adding the total I-CVI for all items and dividing by the total number of items, with .80 or above representing a scale with strong relevance (Polit & Beck, 2006).

The items' reading levels were assessed by using the Microsoft Word, Office 365 version, reading level analyzer. Any item determined to be written above a 6^{th} grade level was rewritten with simpler or more direct language. According to Matsunaga (2010), a priori target

criteria should be established for item retention while developing scales. See Table 10 for initial scale validity protocol.

A pilot study with a student test sample mirroring the actual study participants took the CLCS and select students participated in interviews to determine which questions, if any, were difficult to understand for any reason. Changes recommended as a result of student data were presented to the expert panel for further review. After the final expert panel review, the remaining items were organized into a presentable, multiple-choice, electronic format, following ADA compliance as available.

Table 10

Initial Scale Validity Protocol

Measure	Process	Interpretation	Citation
Face, Content validity	Expert and participant review of the instrument	Solicit feedback to improve appearance and use of the instrument for intended purpose	Devellis, 2017
Content validity	Item-Content Validity Index (I-CVI)	< 0.80 subject items to review	Polit & Beck, 2006
Content validity	Scale-Content Validity Index (S-CVI)	> 0.80 strongly relevant scale	Polit & Beck, 2006
Face validity	Microsoft Word reading level analyzer	Item's above 6th grade will be rewritten	Patten, 2011
Face, Construct validity	Pilot study sample and interview with participants	Solicit feedback to understand experience with questions, amend as necessary	McKenna et al., 2012

Administration of the Pilot Study

After receiving IRB approval, a pilot study was conducted with a small group of students matching the ideal student population using the revised instrument (Johanson & Brooks, 2010). The pilot study participants were a convenience sample representative of the overall intended

study population. They were identified through channels accessible to the researcher due to a currently existing relationship with their parents, who gave consent and provided their student's email address. The pilot study group took the survey and at least one student in each grade, 6-12, was to be invited to participate in an optional phone call or video chat to provide additional feedback on the instrument and the process. The optional follow-ups were established to gain the perspectives of students regarding the length of the measure, their interpretation of the questions, and their thought process while they answered (Patten, 2011). Additionally, the participants were asked to share general comments about the ease of access, directions, and their level of attentiveness throughout the completion of the CLCS (McKenna et al., 2012).

Knowing the size of the pilot sample would be limited, and exercising caution to keep their data confidential, demographic data were not collected. However, during the optional conversations, participants were asked to interpret the meaning of the demographic questions, assess their ability to answer the question, and share how comfortable they might be answering such a question. At the conclusion of the pilot study and conversations, the responses were analyzed to determine if any access issues existed. Additionally, the amount of time spent completing the instrument and answer patterns were considered to determine how attentive the students were to the task of completing the CLCS.

Field Study Sample

This scale is being developed to measure career literacy in adolescents; therefore, the sought-after participants were in grades 6 – 12 based on their student transcripts, or ages 11 – 19 in non-traditional school settings (U.S. Department of Health and Human Services, 2019). Several steps were taken to enhance the generalizability of the study results, regardless of the sample size. According to Hsu & Sanford (2007), individuals with a vested interest are more

likely to participate throughout the process. The researcher sought partners who valued postsecondary preparation. In each school, a CTE teacher was requested as a liaison because they would have a vested interest in the results of this study as the survey content may connect to the curriculum. All of the research partners were to facilitate access to the electronic version of the CLCS. No additional training or prior knowledge was required as inclusionary criteria for teachers or participants.

In order to find a diverse sample that may be generalized to the larger population, the researcher sought participation from research partners that represented residence classifications similar to that of the U.S. population. Wieder (2019) highlighted the Pew Research Center's use of the broad categories, urban, suburban, and rural, to distinguish between the types of residence areas in the United States with a majority of the population classifying their primary residence as urban or suburban. In this study, the researcher sought partners that all three residence types, with a majority in zip codes classified as urban or suburban with some representation of rural zip codes in the schools' zones. Additionally, the partners needed to have a secondary student population that could achieve a robust sample size. After receiving permission to conduct the study with a school district and another partner program, Institutional Review Board (IRB) approval was granted. The initial partners proposed were located in the southeastern United States.

Demographic Data

In their literature study, Rojewski and Xing (2013) note that race/ethnicity is reported in career and technical education research in only a quarter of the research conducted. They concluded that in addition to the omission of race/ethnicity data, other descriptive participant data were left out leaving a true gap in the ability to generalize or make "meaningful

interpretations" of the study's findings (Rojewski & Xing, 2013, p. 252). Fisher and Stafford (1999) also called on future career researchers to identify the similarities and differences that exist in career development based on gender and ethnicity. Because there is a likelihood that the variables will influence the study's reliability, it is critical that they be included. Rojewski & Xing (2013) emphasized the mindfulness that should be considered when reporting descriptive characteristics about research participants.

To improve its reliability, the test needs to be developed in a way that eliminates potential bias. This study will collect demographic data from students to determine what, if any, relationship exists between demographic characteristics and career literacy. Additionally, the results from the measurement of invariance among groups can provide additional validity evidence for validation of the instrument.

In order to analyze the impact of SES on students' academic achievement, researchers use several different methods. In their analysis of information and communication technology (ICT) literacy assessments, which are tests of students' digital literacy skills, Australian Curriculum, Assessment, and Reporting Authority (ACARA) use a parent's highest occupational status and educational level to determine SES (2012). In their attempt to measure the impact of SES on a student's critical nutrition evaluation literacy, Naigaga et al. (2018) used the number of books accessible in the home as an indicator. The authors argue that "the number of books shows clearer differences between children of different backgrounds" (p.4). This study used the students' estimates of the number of books in their homes to measure SES. They chose a range that most closely matched the number of books in their home: 0 – 100, 100 – 200, or more than 200 books available.

Sample Size

The minimum sample size needed to validate an instrument using item response theory depends on a several factors including the test stakes, the parameter model, the internal consistency, and unidimensionality (Immekus et al. 2019; Orlando & Marshall, 2002; Sahin & Anil, 2017). Lord (1968) established the standard for item response theory. The standard posits that a test of 50 items using a 3PL model needs a sample size of $n = 1000$ for accurate model estimation. Since then, the effect of sample size and test length on parameter estimates have been significantly investigated. The notion of "more is better" has been challenged as some of the GOF indices react differently to large samples. Instead, Westland (2010) recommends considering many different facets of the scale and the constructs being measured, with the effect size and number of latent factors as two examples. The literature suggests that changes in parameters, confirmation indices, and the purpose of the test all influence the sample size requirements.

MacCallum et al. (1999) illustrate this when they argue that much smaller samples can give solid results with strong, clear factors. Very specifically, "for a 76-item questionnaire… a subsample of $n = 100$ is sufficient to achieve an adequate match" (p.86). Westland (2010) recognizes that even with a formulaic approach, there are frequent violations of the lower bounds of sample size requirements largely due to the resources, human or capital, at the time of the study. Using the commonly stated formula of 5 – 10 respondents per item does provide researchers with a target number and therefore protects against "the very erratic under-sizing of samples" (Westland, 2010, p. 483).

Edelen & Reeve (2007) indicate that the "sample size should reflect the population of interest and contain enough respondents" (p. 8). When considering the intended use of the test,

Reeve & Fayers (2005) and Sireci (1991) point to a reduced sample for certain testing situations. Several researchers have noted that samples sizes in ranges from 100, 150, 200 up to 1,000 or more could be needed. Hoyle (1995) and Kline (2005) agree that 100 to 200 observations are good for path estimation analysis. Joining the argument, Orlando & Thissen (2000) support the adequacy of samples with 200 or fewer observations.

The participants in this research, adolescents in grades 6 -12, represent the population of interest. According to the literature, literacy is a complex construct to measure because it occurs in many different formats (Heathington, 1987; Horning, 2007; NCTE, 2018; Powell, 1977; Street, 2005). Many of the sample size calculators require an estimate of null hypothesis. Prior to the study, an estimate for this number would be unfeasible. The literature makes several vastly different recommendations for sample size while noting that an increase in sample size usually means a decrease in measurement error. The target sample size for this study is $n = 200$, which is supported by arguments from Hoyle (1995), Kline (2005), and Orlando & Thissen (2000). Kaiser-Meyer-Olkin (KMO) tests provided a measure of sampling adequacy for exploratory factor analysis.

Participant Recruitment

During the item-generation process, the researcher contacted school divisions and programs that would support the study administration, referred to as research partners. A school district and a support program for secondary students agreed to support this research. This written support was used to obtain approval from IRB. The desired school district would be one that provided all of their students with their own electronic device and internet access, where needed. The school district approved distribution of the CLCS to all schools serving secondary

students. Both the school and the program were chosen because the intended impact of the CLCS closely aligned with their mission.

School Distribution. The school district retained the right to distribute the study information to their administrators who were to include study details and participation information in two weekly e-newsletters to parents. This newsletter was sent to all parents who did not opt-out of receiving electronic notifications. The study invitation included a link to the digital parental consent form. Upon digital consent from their parents, the CLCS was to be emailed to the given email using a trigger function in Qualtrics. At that point, students would be able to access the CLCS, provide their assent, and complete the instrument.

Program Distribution. The program director invited the researcher to share study details with parents during information sessions that were held virtually. The parents were given access to the digital consent form during the sessions and in follow-up emails. Students who received parental permission were to be identified by program staff and scheduled to complete the CLCS during a program meeting.

Field Test Administration

The instrument was designed to be administered online. The goal of the instrument is to provide timely results for educators so that students and their parents can understand and act upon them (Balfanz, 2012). Therefore, the validity testing had to also simulate the real testing environment. Because most instruments and inventories offered by counseling staff to determine students' interests and efficacy is done online, one of the recruitment criteria for research partners was student access to laptops and internet service.

The students were presented with several test items that required them to select one correct answer. The scale was designed to measure their skills in the areas of academic

knowledge, critical thinking, grit/resilience/perseverance, and social emotional learning. For example, the questions asked the students to choose appropriate definitions, make decisions based on scenarios, and identify key concepts pertaining to work. After the conclusion of the objective question section, students were invited to share some demographic data. Responses to demographic data were not required for submission, nor was nonresponse established as a rule for exclusion.

The CLCS was distributed electronically using Qualtrics software. All involved research partners place a high value on career preparation. Their interest and understanding of the concept gave them a more meaningful way to explain the opportunity to parents and students. Adolescents have various exposure to the concepts and skills measured in this instrument; therefore, it can be assumed that all participants represented a common experience which can improve the generalizability of the results.

After conferencing with the research partners, the parental consent form was prepared for distribution. The parental permission form provided the purpose of the study, the nature of the confidentiality of the participant's information, the likelihood of any harm that may result from participating in the study, informed them that the study was optional, and provided contact information for the researcher and principal investigator. Additionally, to provide context around the nature of the research, the parental permission form shared sample questions. Parental consent was collected digitally. Parents were given the option of providing their own email, rather than their student's, to alleviate privacy concerns in the school-based administration. The CLCS was programmed to be automatically sent to the given email address for student's completion. The program-based administration only collected parental consent which was shared with program officials to facilitate dissemination of the study during the field-test administration.

Some students received access to the CLCS directly from the program staff and students who were not available on the first day of the administration were sent the link by the researcher.

The established administration schedules included agreement that the researcher would attend or offer information sessions to school or program staff and parents, if needed. The primary contacts were given an opportunity to schedule a pre-survey administration conference to clarify the conditions and other details of the study. The students were asked to thoughtfully answer the questions on the instrument. Demographic questions were presented at the end of the survey to reduce the likelihood that students would not complete the survey due to discomfort with those questions (Patten, 2014).

Data Analysis Plan for the Career Literacy Continuum Scale

The researcher collected student response data for the Career Literacy Continuum Scale (CLCS) to evaluate the established research objectives. This section describes how the data were prepared for analysis and how the analysis was performed. The process is organized at the aggregate level, which includes everything that happened to the entire data set in the process, followed by details of procedures, and then analyses by research objective.

Because each of the goals of this study involved different statistical analyses, the analytical procedures are discussed by goal for ease of understanding. In order to create a valid and reliable measure, each of the three objectives were evaluated. According to Matsunaga (2010), to maintain the validity of the scale, result levels should be determined a priori. Each research objective was analyzed individually and evaluated against a priori criteria.

Data Integrity

The integrity of the data used for analysis directly impacts the quality of the results (Hambleton et al., 2000). The data were reviewed for obvious signs of inattention. In addition to

recording a begin and end time, the CLCS included keystroke timer to measure the time it took for students to transition from one section of items to the next, and a click counter to see how many times the participant clicked in the CLCS. The participant population for the field test administration broadly encompasses students in 6^{th} – 12^{th} grade. A strict cutoff time was not implemented during evaluation because participant ability levels vary across the range of ages. However, during the process of preparing the data for analysis, the researcher reviewed participant test-taking data such as the total time on the test, along with the time between sections to identify patterns of rapid clicking between items and improbable begin and end times to determine if the responses gave any indication of inattentiveness. In addition to time and click checks, responses were visually inspected for repeated answer patterns, for instance an A, A, A, or an A, B, C, D repeating pattern (Patten, 2016).

Missing Data

The data collection software used to administer the test was set to require a response on every item with the exception of the demographic questions. A test may have missing responses if a student exited the test without submitting it. Finch (2008) noted that missing data provides some information on item difficulty as non-response could indicate lower ability. Stover et al. (2019) pointed out that item response theory uses all available information in the calculations known as full information maximum likelihood (FIML). Some of the supporting calculations require a complete observation. The analysis software, STATA, drops observations with missing items listwise as needed to perform calculations. Therefore, observations with missing data were not dropped prior to the import into STATA for analysis.

Coding

The response data obtained from the field study were coded for ease of use by the researcher and to facilitate the statistical analysis. The CLCS is a multiple-choice test which means that the responses are considered binary, either correct or incorrect. For the purpose of analysis, the correct answers were marked in Qualtrics for each question. Correct answers were assigned a score of "1" and incorrect responses received a score of "0". The items were labelled to indicate the concept they measured. For example, "complete a job application" was coded SELAPP, where "SEL" referred to social and emotional learning and "APP" refers to application which can be seen for all items in Table 11. Students indicating their preference for being called female by their friends were coded as "1" and those indicating male as "2". Responses indicating they/them were coded 3. Other demographic data were coded following a similar scheme, using numbers beginning with "1" to represent the first response within each category.

Test Specification for the CLCS

The CLCS was developed to facilitate a student's acquisition of career literacy skills by determining their ability level and positioning their supporters to provide targeted interventions using appropriate developmental activities. The skills and concepts in the CLCS were operationalized and designed to be administered to adolescents in grades 6 – 12 (Valentine & Kosloski, 2021). As a result, the test must provide precise information over a broad range of abilities. Therefore, the item and test information should provide evidence of precise measurement over the entire range of abilities. The test information function should resemble a bell-curve that demonstrates an information peak high in the mid-ability range. The broad range of the test is assumed to be Θ = -3 to +3, where the mid-range falls from -1.5 to +1.5 ability (Baker, 2001; Raykov & Marcoulides, 2018).

In consideration of the age range, attention span, and developmental appropriateness of the target test examinees, the test length and format should be considered to maintain accuracy. Test fatigue increases the likelihood of incorrect answers or non-response to items (Patten, 2016). Test construction considerations should aim to ensure accuracy without sacrificing the reliability of the assessment, which indicates a need to keep only the essential items.

RO_1 Demonstrate Validity of the Career Literacy Continuum Scale

A valid scale is effective at measuring its intended constructs. Validity measurement comes in many forms including face, content, and construct (Devellis, 2017). Construct validity is a more wholistic measure of how well the scale measures what it is supposed to measure (Crocker & Algina, 1986). The collection of multiple data points establishes evidence of construct validity. The face validity of a scale is a "face value" measure of whether or not the scale measures what it intends to measure.

The items for this scale were developed based on the results of a Delphi study conducted with experts to determine consensus on the knowledge and skills necessary for career literate students (Valentine & Kosloski, 2021). Concurrent and convergent validity are additional ways that validity can be measured. Though self-reported measures exist, there are limited test-based measures to use to measure the predictive validity of the Career Literacy Continuum Scale. An expert review panel was integrated into the survey construction process as a way to increase the validity of the scale. The item and scale content validity indices, completed by the expert review panel, were used during the construction of the survey to provide validity to the scale's construct.

RO_2 Determine the Best Fitting Model for the Career Literacy Continuum Scale

Assumption Tests

For an accurate analysis using an IRT estimation, three conditions were assumed, unidimensionality, local item independence (LID), and monotonicity (Hambleton et al., 2000). To confirm that the data met the assumptions, a test was run for each of the conditions prior to the IRT estimation, with the exception of monotonicity, which was analyzed with post-estimation results.

Unidimensionality

A unidimensional scale measures only one latent trait. An exploratory factor analysis (EFA) was run to determine if more than one factor exists. Factor analysis normally requires the use of continuous variables. Because the multiple-choice data from the CLCS were binary, a tetrachoric matrix was used to perform an exploratory factor analysis (EFA). Unidimensional data exhibit high loading on the first factor or has a first factor explaining more than 20% of the model's variance.

During the factor analysis process, the results of several tests were considered collectively using a priori criteria (Cattell, 1966; Devellis, 2017; Pett et al., 2003). The eigenvalues, scree plot, cross-loadings, and the percentage of variance explained by the factors was used as part of the EFA. See Table 11 for the a priori cut off scores established for the exploratory factor analysis.

In order to confirm the unidimensionality of the scale, a confirmatory factor analysis (CFA) was conducted using a one factor model. A collective analysis of tests for goodness of fit will be analyzed using a CFA. As part of CFA, the root means square error of approximation (RMSEA) and the comparative fit index (CFI) were evaluated (Browne & Cudeck, 1992; Hinkin,

1998; Widaman, 1985). The Chi-square (X^2) test was used to evaluate the goodness of the model fit.

Table 11

Exploratory Factor Analysis Unidimensionality A Priori Analysis Criteria

Measure	Evaluates	Rule	Citation
Eigenvalues	Factors to retain	> 1.0, keep factor	Cattell, 1966
Scree plot	Factors to retain	Above the bend, keep factor	Cattell, 1966
Explained variance	Factors to retain	Least factors explaining the most variance, keep factors	

Multiple fit indices were used to determine the model fit: chi-square (X^2), comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Hu and Bentler (1999) offered the following as acceptable a priori criteria: SRMR < 0.09, RMSEA < 0.06, and with coefficient alpha for reliability $\geq$ 0.70 set as a cut-off score. Schumacker & Lomax (2010) offered acceptable CFI criteria as $\geq$ 0.90. Hinkin et al. (1997) indicated significant X^2 results are not acceptable. See Table 12 for the a priori criteria established for CFA. STATA v.17 was the statistical software used to perform the data analysis for the exploratory factor analysis (EFA) and the confirmatory factory analysis (CFA).

Table 12

Confirmatory Factor Analysis Unidimensionality A Priori Analysis Criteria

Measure	Evaluates	Interpretation	Citation
RMSEA	Goodness of model fit	> 0.06 acceptable fit	Hu & Bentler, 1999
SRMR	Goodness of model fit	> 0.09 acceptable fit	Hu & Bentler, 1999
X^2	Goodness of model fit	Nonsignificant result	Hinkin et al., 1997
Comparative Fit Index (CFI)	Goodness of model fit	$\geq$ 0.90 acceptable fit	Schumacker & Lomax, 2010
Coefficient alpha	Reliability	$\geq$ 0.70 acceptable	Hu & Bentler, 1999

Local item independence

Items that are locally dependent are dependent on another item for a correct response. A violation means that responding correctly to one item predicts the probability of answering another item correctly. “Unidimensionality is a sufficient condition for local independence” (Warm, 1978, p. 107).

Monotonicity

An IRT estimation requires monotonicity. The model should clearly show that a test-taker with more ability will perform better on the test. The researcher performed an analysis of item characteristic curve (ICC) data after selecting the most appropriate test model. The data table and a visual inspection of the ICC graph were analyzed to confirm that the assumption of monotonicity was met. The slope of the line should demonstrate that probability of a correct answer is associated with high ability level.

Model Fit Test

The usefulness of IRT analysis depends on the accuracy of the model-data fit which “can be assessed through the comparison of nested models” (Edelen & Reeve, 2007, p. 8). The CLCS was hypothesized to be a three-parameter logic model (3PL) because its calculations include the probability of guessing, which is a concern when modeling K-12 tests (Bartolucci et al., 2015). Investigating goodness of fit (GOF) alongside other models provides the researcher with comparative data which can be analyzed to determine the best model fit (Immekus et al., 2019). To determine the best model-data fit, one-parameter (1PL), two-parameter (2PL), and three-parameter (3PL) models were analyzed concurrently using the Akaike Information Criterion (AIC; Akaike, 1974), the Bayesian Information Criterion (BIC; Schwarz, 1978), the likelihood-

ratio statistic (-2LL), and the square root mean residual (SRMR; Maydeu-Olivares, 2013). Table 13 shows the information provided by and the interpretation of each test.

Table 13

Goodness of Model Fit Test Analysis Criteria

Test	Interpretation	Citation
Akaike Information Criterion (AIC)	Lower number is best fit	Akaike, 1974
Bayesian Information Criterion (BIC)	Lower number is best fit	Schwarz, 1978
Root Mean Square Error Analysis (RMSEA)	Lower number is best fit	Maydeu-Olivares, 2013
Standard Root Mean Square Residual (SRMSR)	≤ 0.05, good fit	Maydeu-Olivares, 2013

Item Analysis and Selection

The 3PL model was hypothesized as the best IRT model for the CLCS. Post estimation goodness of fit (GOF) tests were used to confirm this hypothesis. The best fitting model was adopted for item analysis (Bichi et al., 2016). Using data from the best fitting model, the discrimination (a) and difficulty (b) parameters for each item were examined to determine the extent to which they met acceptable criteria. “The difficulty of an item describes where the item functions along the ability scale” (Baker, 2001, p.7). Item discrimination “describes how well an item can differentiate between examinees having abilities below the item location and those having abilities above the item location” (Baker, 2001, p.7). An interpretation of the item’s discrimination value indicates the location on the ability scale where the most information is available about examinees at that ability level.

Adolescence is defined by an age span of approximately 10 years (HHS, 2019) and is characterized by periods of uneven cognitive growth. It is assumed that this category of

respondents also represents a large range of abilities; therefore, item difficulties should also represent a range. Baker (2001) assigned verbal correlations to difficulty (Θ) levels: very easy (-3), easy (-1.5), medium (0), hard (1.5), and very hard (3+). Within a normal test range, usually represented by -3 to 3, 0 is considered medium, with negative points representing easier items and positive points representing more difficult items. The CLCS item characteristic curve (ICC) data were inspected to locate items that demonstrated item difficulty within the easy to hard range, representing values Θ = -1.5 to 1.5 (Baker, 2001).

Item discrimination is provided for each item in the 2PL model, where the 1PL model holds discrimination constant across all items. Items with a very high discrimination are $a \geq 1.70$ and high discrimination (a) ranges from 1.35 – 1.69. Moderate items are defined by discrimination (a) values ranging from 0.65 – 1.34. Items with values 0.35 – 0.64 are low and 0.01 – 0.34 are very low (Baker, 2001). Table 14 below provides the discrimination (a) interpretation criteria. Figure 4 illustrates the interpretation of the theta.

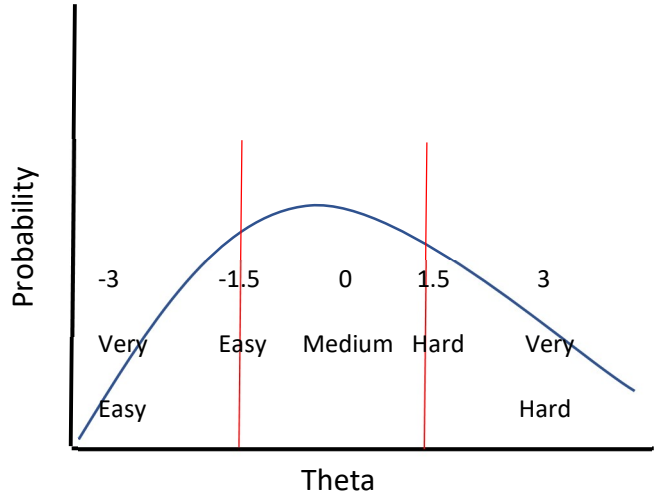
Table 14

IRT Discrimination Analysis Criteria

Discrimination Value (a)	Interpretation
0.01 – 0.34	Very low
0.35 – 0.64	Low
0.65 – 1.34	Moderate
1.35 – 1.69	High
1.70 – above	Very high

Figure 4

Interpretation of IRT Graphs



Item selection is also based on the total amount of information it contributes to the test (Hambleton et al., 1991). For this research, items were chosen based the analysis criteria identified during the test's specification. The best fitting model was evaluated again with only the retained items using the previously established a priori test specifications (Embretson & Deihl, 2004; Ezechukwu et al., 2020).

Construction of the Career Literacy Continuum Scale

Analyzing the internal structure of a test can provide data about the degree to which the item and test data support the assumption that the test measures the intended construct. Item response theory (IRT) model estimations were used to analyze the internal structure of the CLCS. After the best model was chosen, the discrimination (a) and difficulty (b) values were evaluated along with the ICC and IIF graphs using the established a priori criteria and problematic items were removed. The 2PL estimation was redone to determine and the resulting estimation will be evaluated to determine the final test reliability data.

RO_3 Demonstrate the Reliability of the Career Literacy Continuum Scale

The final objective of this research was to establish the reliability of the Career Literacy Continuum Scale. The reliability of an instrument demonstrates the frequency with which results consistently measure the intended latent construct. Unlike classical test theory (CTT), which provides reliability estimates of the entire instrument or scale through the coefficient alpha, the item response theory (IRT) model provides data at both the item and test level that are helpful for evaluating the reliability of the test for measuring its intended purpose, in addition to the coefficient reliability data (Champlain, 2010; Edelen & Reeve, 2007). The model fit, item characteristics (ICC), item information function (IIF), test characteristic curve (TCC), and test information data (TIF) were used collectively to provide reliability evidence (Makransky et al., 2015). The KR20 statistic provided internal consistency data.

In order to determine the reliability of the test, using the IRT model, the test developer must identify the intended purpose of the test which, in turn, dictates the appropriate thresholds for analyzing the items and fit as a whole (Baker, 2001). Tests are designed to provide precise predictions about the potential examinee's level of the latent trait (ability; Hambleton et al., 2000). A test's specifications are critical to conducting meaningful analysis using the IRT model. Each stage of analysis requires an understanding of the intended purpose of the test for decision making (Baker, 2001).

Reliability Analysis of the Career Literacy Continuum Scale

A reliable scale consistently measures the desired constructs and demonstrates high levels of internal consistency. After the item selection process, the 2PL models was estimated with the remaining items which was the final version of the CLCS. The final construction of the CLCS was evaluated with that estimation and post-estimation data. The coefficient alpha and

differential item functioning were also evaluated using the new estimation results. In this study, the coefficient alpha from the KR20 calculation was used to demonstrate the internal consistency of the CLCS (Crocker & Algina, 1986). The item and test information functions provided additional reliability data.

Coefficient alpha

Coefficient alpha is a measure of a test's internal consistency and provides a measure of reliability (Crocker & Algina, 1986; Devellis, 2017). Dichotomously scored measures use the Kuder-Richardson 20 (KR20) formula to compute a reliability coefficient (Crocker & Algina, 1986; Cronbach, 1951; Devellis, 2017). Nunnally (1978) established $\alpha \geq 0.70$ as an adequate level of reliability, with $\alpha \geq 0.80$ considered a good level of reliability. The KR20 reliability analysis was run post estimation to provide a measure of the CLCS in its final form.

Item information data

Reliable items relate the most information about the target examinees. Items with high information at polar (low or high) ability levels are not a reliable estimate for all examinees (Baker, 2001). For this test, items within the target range of $\Theta = -1.5$ to 1.5 were automatically retained. Items outside the range were evaluated based on discrimination and difficulty statistics to determine whether they should be retained or removed.

Test information data

A reliable test used to assess a general population of students should have consistent information across all ability levels. Test information data were examined for polarity as well as the marginal reliability score, which can be interpreted in a manner similar to the coefficient

alpha (Knoll & Houts, 2012). A desirable test information function (TIF) for this instrument has gentle curves with the most information represented in the range of Θ = -1.5 to 1.5.

Differential Item Function (DIF) data

Differential item function (DIF) statistics provide data on item invariance between groups. DIF tests were run on items by grade level, number of books (as an SES measure), and gender to determine if items performed different by group. A likelihood ratio chi-square (X^2) test will be reviewed for significant results. Table 15 is a brief summary of the evidence collected to support the validity and reliability of the Career Literacy Continuum Scale.

Summary

Chapter III describes the way that the Career Literacy Continuum was developed. The process was influenced by a method outlined by many scholars, in particular, Devellis (2017), who has published numerous articles and books about scale development. Throughout the chapter, consensus on each procedure is indicated by multiple scholarly articles using the same statistical procedure. The researcher established a priori criteria based on extant literature before conducting the study to add to the validity of the study's results.

The items for the scale were first generated by the researcher based on the literature, using a Delphi study that synthesized experts' consensus on the details of the constructs. They were then reviewed for content validity by a panel of expert reviewers. The instrument was then administered to a pilot group of students who represented the target participant sample. The results of the feedback from the pilot study participants and a subsequent review by the expert reviewers contributed to revisions of the instrument. The resulting instrument was used to conduct the field test administration.

After obtaining the proper authorization from the university and research partners, the researcher attempted to gain the most geographically diverse sample. The results of the CLCS were analyzed using an item response theory estimation.

During the IRT analysis, additional analysis of the Career Literacy Continuum Scale was evaluated for goodness of model fit and item- and test-characteristics. The a priori criteria for decision making were outlined in a table to provide the reader with an organized opportunity to follow the process. The results of the analysis will be reported in Chapter IV.

Table 15

Summary of Evidence to Support Research Objectives

Research Objective	Source of Evidence	Type of Evidence
1. Establish validity		
	Clearly defined latent trait	Content Validity
	Test matrix	Content, Construct Validity
	Expert review of item pool	Content, Construct, Face Validity
	Item- and Scale-Content Validity Index, before and after	Content Validity
	Pilot administration	Face, Content Validity
	Participant feedback	Face Validity
	Confirm model fit	Construct validity
2. Determine model fit		
	Model assumption tests	Confirm unidimensionality
	1-, 2-, 3- parameter estimations	Test and item data
	AIC, BIC, X^2	Model comparison
3. Establish reliability		
	KR20	Internal consistency
	1-, 2- parameter estimations	Test and item data
	Differential item functioning	Invariance between groups

CHAPTER IV

FINDINGS

Career literacy is a person's ability to read, understand, evaluate, and make decisions based on career-related information. A Delphi study operationalizing the latent trait yielded 50 specific skills and concepts that adolescents should know and be able to do if they are career literate (Valentine & Kosloski, 2021). The purpose of this study was to develop a valid and reliable measure of these skills which, for the purpose of this study, will be called the Career Literacy Continuum Scale (CLCS).

Chapter 3 provided the methodology for the study which established an approved approach to conduct the study. The purpose of this chapter is to provide the findings from each step of the study. It details the process undertaken to develop the instrument, recruit participants, administer the field study, and finally, analyze the collected data. The research goals and objectives follow.

Research goal: Develop a valid and reliable measure of students' career literacy skills called the Career Literacy Continuum Scale.

Research objectives:

RO_1: Demonstrate validity of the Career Literacy Continuum scale.

RO_2: Determine the best fitting model for the Career Literacy Continuum scale.

RO_3: Demonstrate reliability of the Career Literacy Continuum scale.

The data for this study were collected in two distinct phases. The goal of phase one was to prepare the instrument and establish initial validity evidence. The goal of phase two was to conduct a field test of the CLCS and provide empirical evidence for the reliability of the Career

Literacy Continuum Scale. The process involved several steps which are detailed in Figure 3.

Formative Preparation of the CLCS for Field Testing

An instrument's strength is derived from evidentiary support of its development, including validity, face, content, construct, and reliability data (Crocker & Algina, 1986; Devellis, 2017). Evidence to establish and support the validity of the CLCS was gathered through several steps which are reflected in Table 10. A professional psychometrician, content experts with education and research experience, and students mirroring the desired demographic provided feedback before and during the pilot administration. Feedback from the respective individuals was incorporated into the field test version of the CLCS.

RO_1: Demonstrate validity of the Career Literacy Continuum Scale

A valid scale measures the intended construct. The purpose of the CLCS is to determine an adolescent's level of career literacy. The validity of a scale can be determined by evaluating multiple points of supporting evidence. First, the literature was consulted to inform the definition of the latent trait. A variety of evidence to support its validity was collected during the development and analysis of the CLCS. The process recommended by Devellis (2017) includes steps that result in the construction of a valid instrument. Next, a panel of experts were included to evaluate the content validity of the items, and to provide feedback on the face validity. Following the expert review, a pilot administration to a mirror sample provided feedback on the accessibility and test taking experience. Finally, a field test administration was conducted to gather data about the items and model fit.

Test Blueprint

Through a Delphi study with content experts, Valentine & Kosloski (2021) operationalized career literacy into 50 skills and concepts that adolescents need to be considered career literate. The literature was used to develop a test blueprint to keep guide test development. A test blueprint provides an additional layer of validation for the instrument. The blueprint can be developed using a variety of strategies. The purpose is to make sure that the final instrument includes all of the topics to be measured. Because career knowledge is seldom measured using multiple-choice questions, a precedent for deciding a concept's weight and number of questions needed to measure the concept was elusive, so the researcher decided to include at least one question for each concept. The test blueprint for the CLCS was developed by making a list of the career literacy skills and concepts identified in the literature. The initial item pool was later developed using the blueprint as a reference. After the item-pool was developed, each item was assigned to the concept it was intended to measure and shared with the expert reviewers for evaluation. Some items were considered to measure more than one skill see Table 16.

Instrumentation for the Career Literacy Continuum Scale

Assessment of understanding is possible through many formats. Choice of measurement is largely driven by purpose of the assessment, the content, the ability-level of the primary audience, available resources, and access by both the audience and the assessor (Baker, 2001; Hambleton et al., 2001). Career literacy, as with most other literacies, is a complex body of skills with some appropriately measured through multiple-choice and some skills requiring other methods of demonstration (Valentine & Kosloski, 2021).

With limited access to the target audience, virtual interviews and multiple-choice questions were the primary options remaining for assessment of career literacy skills. Interviews

would provide a richer depth of information; however, as a verbal self-report, they posed the same risk of over-reporting found in self-assessment scales. Based on the participant access available to the researcher during the development of the instrument, it was not possible to create questions that would have required in-person evaluation.

The original concept map of the test indicated questions with a variety of response types, including drag and drop, ordering, and multiple choice. As an example, a drag and drop question was created that required students to drag the correct elements of a résumé to the response area. Unfortunately, those formats were not supported on smaller mobile devices like cell phones. One of the initial administrative decisions was to provide equity of access to the Career Literacy Continuum Scale using any device. At the same time, the tactile requirements of those formats did not meet accessibility standards.

Due to the versatility, broad sampling ability, and likelihood of a stronger participant response, the researcher developed the test to be administered completely online (Denscombe, 2009). The interactive question types were eliminated prior to sharing the test with the expert reviewers, which also meant that several skills were revised to meet the multiple-choice format. Other questions were removed after the expert review. The panel identified several questions that represented skills that were not best addressed through a multiple-choice question.

Item Bank Development

The items on the Career Literacy Continuum Scale (CLCS) were drafted with input from 6^{th} – 12^{th} general and special education teachers, college and career specialists. Other career professionals were consulted to determine situations that would be authentic and provide a range of reasonable, practical work-based or real-life scenarios that addressed the intended skills and concepts through the lens of multiple careers.

Table 16

Blueprint of the CLCS

Theme	Learning Targets	Question number		Code
AK	Identify basic requirements of a job to determine whether one meets said requirements			AKBASI
AK	Identify the steps needed to gain the required skills toward entry into a career	42 (1)	34 (2)	AKSTEP
AK	Knowledge of career options and job outlooks and how Career Clusters and Pathways are connected to career exploration	43		AKEXPL
AK	Manipulate basic math functions, exemplifying data literacy	1		AKMATH
CT	Ability to determine the overall financial cost to prepare for a career			CTFIN
CT	Adjudicate facts versus opinions	28		CTFACT
CT	Analyze an environment to address barriers to career entry		-	CTBARR
CT	Analyze ones' role in a specific task or work environment			CTROLE
CT	Analyze simple and complex written instructions to perform a task	44		CTTASK
CT	Analyze the credibility of a source of information	4		CTCRED
CT	Apply what has been read to real-world situations	40		CTREAL
CT	Apply written, verbal, and digital information to solve problems	2		CTSOLV
CT	Ask questions that will expand the narrative and discussion in an organization			CTASKQ
CT	Ask the "right" questions to seek answers, provide clarity, or to problem-solve	18 (1)	32 (2)	CTNARQ
CT	Calculate the consequences of irrational long-term and career-limiting decisions	24		CTCONS
CT	Conduct career research to inform career decisions	20 (1)	22 (2)	CTDEC
CT	Decipher information presented in different forms (orally, written, visually, etc.)			CTFORM

CT	Indicate how different skill sets and predispositions relate to different career fields	17		CTSKIL
CT	Interpret information from datasets, or others graphical representations of data	33 (1)	3 (2)	CTINTR
CT	Match ones' own values, interests, and skills, with a compatible career	5		CTMTCH
CT	Read, process, and interpret career information regarding employment	6		CTREAD
CT	Relate ones' own academic/skill portfolio with desirable career paths	21		CTREL
CT	Translate career progressions and different steps within a career ladder	16		CTLADS
GRIT	Acknowledge expertise/experience as beneficial qualities to seek in career advisors	25		GRITEXPT
GRIT	Acknowledge the importance of persistence and follow through	15		GRITPRST
GRIT	Advocate for oneself with respect to ones' career (ex. calling to schedule an interview)	13		GRITADV
GRIT	Analyze ones' own self values, skills, apprehensions, fears, knowledge, and incompatible work settings, and how these things play a role in ones' success within a particular position	26 (2)	27 (2)	GRITVALU
GRIT	Immerses oneself in field experiences or similar environments to gain a better understanding of a career			GRITIMSE
GRIT	Knowledge of one's own past triggers, as a precursor to managing professional demeanor in a given environment	-		GRITTRIG
GRIT	Take the initiative to seek out career information and discuss it	23		GRITINIT
GRIT	Use one's own discernment, empathy, and grit in communication and goal setting	36		GRITDISC
GRIT	Utilize feedback and advice to advance one's range of career opportunities			GRITFDBK
SEL	Articulate ones' own skills/values, transferable skills, and career goals	7		SELARTG
SEL	Articulate skills possessed through the completion of a resume			SELARTS
SEL	Collaborate with others and be open to other's ideas			SELCOLL
SEL	Communicate personal career interests and discuss career opportunities with prospective employers and other influencers	39		SELDISC

SEL	Communicate with experienced people with respect to a given career field				SELEXPP
SEL	Complete a job application	8			SELAPP
SEL	Contact, obtain permission, and prepare a list of professional references appropriate for a specific job opportunity	38			SELREF
SEL	Effectively communicate orally and in writing related to work performance		-		SELCORAL
SEL	Exercise emotional intelligence and empathy				SELEMOT
SEL	Interpret professional etiquette expectations (communication, attire, topics, etc.), as well as how those expectations may vary from one career to another	14 (1)	37 (2)	-	SELETIQ
SEL	Knowledge of appropriate vernacular by audience (code-switching)				SELCODE
SEL	Knowledge of the elements of good teamwork, as well as the importance of working on a team	9 (1)	11 (2)	12 (3)	SELELEM
SEL	Knowledge of your own bias and its impact on your assumptions and interpretations	31			SELBIAS
SEL	Listen thoroughly, show empathy, and a genuine effort to interpret the speaker's perspective, both implicitly and explicitly				SELLSTN
SEL	Self-assess with honesty and forthrightness			-	SELHNST
SEL	Speak articulately and generally communicate orally in a professional manner				SELSPEA
SEL	View things from others' perspectives, understanding that inters with others often have little to do with oneself and more to do with others	30			SELVIEW
SEL	Work collaboratively with diverse groups	10			SELDVRS

Item Evaluation

A test is said to have face validity if it appears to measure what it is intended to measure (Devellis, 2017). Evidence for the face validity of this study was collected from everyone who participated in the instrument's formative development. An instrument has content validity when it measures the concepts it is intended to measure (Crocker & Algina, 1986; Devellis, 2017). A

content validity index was calculated for each item and the entire scale as a whole based using the process outlined by Polit & Beck (2006). The next section explains the CVI evaluation process in more detail and provides the results.

Expert Review of Content Validity

One piece of evidence that demonstrates an instrument's validity is a review by content experts. For this study, three content area experts were invited to analyze the content of the initial item bank. The expert review panel members were selected for their cross-sectional knowledge of K-12 students ability levels and attitudes and grounding in current workforce education literature. The panel was comprised of:

- an established researcher in the area of workforce development, who holds a Ph.D., and is current university faculty member,
- a novice researcher in workforce education, (doctoral student) who is both a former university adjunct and K-12 faculty member, and facilitator for a bridge to college summer program, and
- a work-based learning specialist with program management experience, in addition to K-12 faculty member experience.

After the initial test draft was completed with questions proposed to meet all of the career literacy skills, the review panel was provided with background information about career literacy, the purpose of the test, and what their participation entailed. The reviewers were emailed a link to the review form that was created in Google. A reminder email was sent to all three reviewers at two weeks, another reminder went out at four weeks to two reviewers, and at six weeks to the third reviewer. All three reviewers completed the entire content validity index form.

Content validity index (CVI). A content validity index provides statistical analysis that

demonstrates the content validity of an instrument. The draft instrument and parental consent were prepared for an initial review and feedback by content experts and two parents of high school students. The content evaluation tool for the expert reviewers was prepared using Google so that each question and its intended skills could be analyzed in isolation. Each question, along with its answer choices were presented as an image. The associated career literacy skills were listed along with a Likert type rating scale with 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = highly relevant. This provided the experts with an opportunity to rate the relevancy of each question to demonstrate knowledge or competence of the associated skills.

Following the process highlighted by Polit & Beck (2006), the rater's responses were prepared for analysis in Excel. A content validity index score was calculated for each item (I-CVI) by adding up the number of responses receiving a rating ≥ 3, indicating quite relevant or highly relevant, and dividing that number by the number of reviewers (3). With three reviewers, four levels of agreement were possible. Items receiving a score of 1 were considered strongly relevant. Items with scores of 0.66 (2 reviewers agreed to relevance) were maintained but feedback comments were reviewed and used to make revisions to the items. Items with 0.33 (1 reviewer agreed) or 0 (no reviewers agreed) were deleted; see table 17 for I-CVI scores for each item after the expert review. The scale content validity index (S-CVI) was calculated after obtaining a CVI for each item. At the conclusion of the review, prior to the field test administration, the S-CVI was 0.92 which is considered strongly relevant.

Table 17

Item Content Validity Index

Item ID	Rater 1	Rater 2	Rater 3	Item Average	I-CVI
AKEXPL	3	4	3	3.33	1.00
AKMATH	4	4	4	4.00	1.00
AKSTEP1	3	4	3	3.33	1.00
*AKSTEP2	3	4	2	3.00	0.67
CTCONS	4	4	3	3.67	1.00
CTCRED	4	3	3	3.33	1.00
CTDEC1	3	3	4	3.33	1.00
CTDEC2	3	4	3	3.33	1.00
CTFACT	3	4	4	3.67	1.00
CTINTR1	4	3	3	3.33	1.00
CTINTR2	4	4	3	3.67	1.00
CTLADS	4	3	4	3.67	1.00
CTMTCH	4	4	4	4.00	1.00
CTNARQ1	4	4	4	4.00	1.00
CTNARQ2	3	3	4	3.33	1.00
CTREAD	3	4	4	3.67	1.00
*CTREAL	4	3	2	3.00	0.67
CTREL	4	3	4	3.67	1.00
CTSKIL	3	4	3	3.33	1.00
CTSOLV	3	4	4	3.67	1.00
CTTASK	3	4	4	3.67	1.00
GRITADV	2	3	3	2.67	0.67
*GRITDISC	3	2	3	2.67	0.67
GRITEXPT	3	3	4	3.33	1.00
GRITINIT	4	3	3	3.33	1.00
GRITPRST	4	4	3	3.67	1.00
GRITVALU1	4	3	4	3.67	1.00
*GRITVALU2	2	4	4	3.33	0.67
[a]NOTUSED	3	2	2	2.33	0.33
SELAPP	4	3	4	3.67	1.00
*SELARTG	2	4	4	3.33	0.67
SELBIAS	4	4	4	4.00	1.00
*SELDISC	4	4	4	4.00	1.00
*SELDVRS	3	4	4	3.67	1.00
SELELEM1	3	4	4	3.67	1.00
SELELEM2	4	4	4	4.00	1.00
SELELEM3	4	4	4	4.00	1.00
SELETIQ1	2	3	3	2.67	0.67
SELETIQ2	4	4	4	4.00	1.00
SELREF	4	4	4	4.00	1.00
SELVIEW	4	4	4	4.00	1.00
Scale CVI					0.92

Note. *Revised items. [a] removed as a result of a low CVI.

Face Validity

An instrument with face validity appears to be valid though it may not have empirical evidence to analyze or demonstrate that fact. A psychometrician was included as a test development expert to provide an expert review of the test to observe and evaluate the test's appearance for professionalism and content overall. The test expert, who holds a Ph.D. in research, statistics, and evaluation, has also worked in academic analytics, test analysis, and holds a leadership role in a school district testing office.

During the initial communication, the researcher informed the psychometrician of the purpose of the study and provided background information on career literacy and the research process. The psychometrician agreed to provide feedback ahead of the commencement of the study. The instrument draft was provided to the psychometrician, and reminders were sent at two weeks and four weeks, without response. After eight weeks, feedback was received from the psychometrician and was aligned with the other content reviewers.

The reviewers' overall face evaluation feedback was conceptual with main findings about the length of the instrument and the number of constructs being measured. A recommendation to clarify the introduction of the instrument was made, mirroring a previous observation from parents which was corrected. The psychometrician was able to determine the distinctive concepts intended for measurement which indicates a positive face assessment. Additional face validity data were provided from the school district partner during their evaluation of the research application. They approved the research application; however, the length of the CLCS prevented its completion during instructional time.

Additionally, the reviewers' feedback provided recommendations for changing items to measure the intended content or the feasibility of a multiple-choice question to accurately

measure a specific skill. At the end of each section, the pilot test participants were asked to indicate whether or not they found any of the questions confusing. In total, three affirmative answers were recorded. When yes was selected (to indicate a confusing question) a response box was presented to collect additional information. Participants were also provided with a space at the end of each section to record any questions they had. One comment was received at the end of the first set of questions. It provided the response, "the second question", which alerted the researcher to a typographical error. The confusion was due to a missing zero in "$150,00", which should have been "$150,000" and was considered a material observation. No additional substantive feedback was provided by the pilot study participants.

Reading Level

As one part of the evidence of validity for the CLCS, the writing level was evaluated by the expert reviewers, the pilot test participants, and MS Word for the Flesch-Kincaid grade score. The MS Word Flesch-Kincaid Grade was determined to be 6.1. The age range for adolescence ranges between 11-19, corresponding to around 6^{th} – 12^{th} grade, and because 6^{th} grade is the standard for public writing, the assigned grade of 6.1 is appropriate (Schinka & Borum, 1993).

Pilot Test Administration

DeVellis (2017) indicated the process of pilot testing for instrument development (2017). McKenna et al. (2012) expanded on the importance of soliciting user feedback during the instrument development process. The purpose of this pilot test was to collect data on:

- the process for parents' ability to provide consent electronically,
- the process for sending the instrument to students using the Qualtrics trigger,
- the students' ability to access the instrument,

- the students' feedback regarding question confusion and difficulty, and,
- the length of time the instrument took to complete.

Additionally, two students who took the assessment were to participate in a follow-up interview with the researcher to provide depth to the process or questions on the test.

Pilot Study Recruitment

The researcher used their personal network of parents and children who met the study's participation criteria to ask permission for them and their students to participate in the pilot research process. The parents were contacted via text to request permission to email them with details about the purpose of the study, instructions for providing access, and an outline of what their students participation would entail. Emails were sent to 24 parents to potentially gain permission for 30 students to participate in the pilot study. Parental permission triggered the Qualtrics software to send the instrument to the email they provided.

Participant Profile

After providing a reminder at two weeks, parental consent was provided by 13 parents who represented 15 students. Student participation in the survey took place over four weeks although the number of consenting parents did not increase after two weeks. The total number of students completing the assessment was 13 and one assessment was started but never completed.

Pilot Test Data

This section provides the data collected during each step of the pilot test phase. The pilot test yielded information that was valuable beyond the statistical tests and validity evidence. An observation of the digital habits of parents and students provided a glimpse into the parents' communication with their students and their comfort level with sharing their students' information. Additionally, as a result of conducting a pilot study, the researcher was able to gain

insight into parents' comfort levels with the consent directions. This deeper understanding was necessary to the preparation and planning of the field test distribution and was essential to facilitate the ease of access and completion. The consent form completed by the first few pilot parents highlighted a concern which led the researcher to invite a literacy specialist to review the consent instructions and recommend changes for increased clarity. The recommended changes centered on preparing parents for the lengthy consent form approved by the Old Dominion University Institutional Review Board (IRB). Highlights of the recommendations included incorporating an introduction page, a brief purpose of the study, a bulleted list of what was needed from parents in process, and an acknowledgement of the length of the parental consent form. The IRB approval is included in Appendix A.

Parental consent. The school district providing authorization for the field test research included the caveat that they would not provide personnel to distribute or collect parental consent. It was important for the parental consent to be accessed and completed easily. The link for the parent consent was included in the introductory email. An analysis of the data revealed that parents were able to successfully complete the consent, which consisted of entering their name and providing an email to which the instrument would be sent. Parents were given the option of providing their own email, rather than their student's, to alleviate privacy concerns. Two parents completed the consent form twice using differing versions of their name. Options to decline consent or ask further questions were also available. None of the pilot study parents selected those options.

Instrument distribution. Because the researcher was not invited to be on hand to administer the instrument in the field test, a digital distribution process was developed for the pilot test administration to test and ensure access to the instrument. The researcher established the

distribution process using the trigger process in Qualtrics. After parents completed the consent form, an email containing directions and a link to the CLCS was sent to the email address listed in the form. The researcher realized that the trigger process was not working properly when reviewing the results of the first two parental consent completions. Adjustments were made to correct the problem. A manual email was sent to the emails provided and the consents that followed received the access email with no further problems.

Student access. The students received access to the CLCS either directly from the email trigger in Qualtrics or from their parents. The number of participants completing the instrument (n = 13) indicated that students were able to access to the instrument. They did not provide any personally identifiable information. Therefore, the researcher could not determine if unclear directions, disinterest in participation on their own time, or not receiving the instrument from their parents were among the reasons the other two students, whose parents gave permission, did not access the CLCS.

Student feedback. During this pilot phase students were asked for feedback in one of two ways. First, the instrument was amended in Qualtrics to provide room for comments at the end of each section. The pilot participants provided two comments on the survey form. The most actionable feedback was the report of a numerical expression error, "$150,00" instead of "$150,000." The remaining feedback was generally nondescript. For example, one student commented "confusing" but did not provide any additional information like question number or what specifically was confusing. One parent contacted the researcher to provide details about their student's confusion with an image that was particularly difficult to view, which was subsequently corrected.

Additionally, two students were randomly selected to participate in an interview. The

researcher put in the names of the parents who provided consent into a randomizer. The parents provided contact information for the researcher to contact their students. Using the research interview protocol, the researcher asked the students to answer questions about their experience with the test, see Appendix D. The conversation with each student lasted approximately five minutes. The pilot interview students shared similar responses. They indicated that they were able to easily access the CLCS, the majority of the questions made sense, and everything was "fine." Interestingly, neither student was able to share an estimate of time they took to complete the CLCS.

Time information. According to Patton (2016), it is important to make sure participants are actively engaging in the instrument and not randomly clicking through the questions to get to the end. The researcher incorporated the Qualtrics timer feature on the instrument to determine the amount of time elapsed between the initial click on the section and when the student clicked to proceed to the next section. The timer also recorded the number of clicks per section. The student timing and click data ranged widely on some of the sections. The amount of time spent on some completions was clearly longer (3 hours to 36 hours) than the time it should have taken to complete the instrument in one sitting.

Impact of Formative Preparation on Field Test Instrument

The instrument development process requires a comprehensive approach to ensure validity and reliability. The pilot process for the Career Literacy Continuum Scale included expert review and an administration to a participant group mirroring the full study with feedback requested from each. Overall, feedback from the pilot participant group provided material improvements of two questions. At the same time, the CVI evaluation resulted in 3 items being removed from the final administration. As a result of item and skill removal, 15 concepts are no

longer measured on the field test version of the CLCS, see Table 18. See Table 15 for a summary of the data collection processes and intended outcomes.

Table 18

Career Literacy Skills Not on CLCS

[a]Theme	Learning Targets	Code
AK	Identify basic requirements of a job to determine whether one meets said requirements	AKBASI
CT	Ability to determine the overall financial cost to prepare for a career	CTFIN
CT	Analyze an environment to address barriers to career entry	CTBARR
CT	Analyze ones' role in a specific task or work environment	CTROLE
CT	Ask questions that will expand the narrative and discussion in an organization	CTASKQ
CT	Decipher information presented in different forms (orally, written, visually, etc.)	CTFORM
GRIT	Immerses oneself in field experiences or similar environments to gain a better understanding of a career	GRITIMSE
GRIT	Knowledge of one's own past triggers, as a precursor to managing professional demeanor in a given environment	GRITTRIG
GRIT	Utilize feedback and advice to advance one's range of career opportunities	GRITFDBK
SEL	Articulate skills possessed through the completion of a resume	SELARTS
SEL	Collaborate with others and be open to other's ideas	SELCOLL
SEL	Communicate with experienced people with respect to a given career field	SELEXPP
SEL	Effectively communicate orally and in writing related to work performance	SELCORAL
SEL	Exercise emotional intelligence and empathy	SELEMOT
SEL	Knowledge of appropriate vernacular by audience (code-switching)	SELCODE
SEL	Listen thoroughly, show empathy, and a genuine effort to interpret the speaker's perspective, both implicitly and explicitly	SELLSTN
SEL	Self-assess with honesty and forthrightness	SELHNST
SEL	Speak articulately and generally communicate orally in a professional manner	SELSPEA

Note. a AK = Academic knowledge, CT = Critical thinking, GRIT = Grit, resilience, perseverance, SEL = Social and emotional learning

Field Test Administration

Sampling Procedure

The Health and Human Services Department defines adolescents as individuals between and encompassing the ages of 11 – 19 (HHS, 2019). In the U.S. public school system, those ages translate to grades 6 – 12, also referred to as secondary schools. The population eligible for participation in this study were individuals in grades 6 - 12 who could access the CLCS without paying for internet access.

Recruitment. Because of the age of the sample group, a letter of research support or approval was required in order to receive approval from the ODU Institutional Review Board. The researcher contacted several school districts to determine one that would review the research application prior to an IRB approval. A school district in the southeastern United States provided approval to administer the study with 6^{th} – 12^{th} grade students. The school district initially authorized distribution by all secondary school administrators in the district through their weekly parent newsletter. In the approved process, parents were to give consent and a contact email, via a digital link to Qualtrics. Information about the study, participation, and parental consent were to be included in the weekly newsletters of all schools, according to the original agreement. However, only six schools were actually provided the study information.

The researcher continued recruitment efforts to create access to enough students in the target population. A second program offered formal support and invited the researcher to speak at five back to school information sessions. The initial intent was to have students complete the CLCS during their regularly scheduled meeting time. However, because the parental response was sporadic, it was decided that the students in the program would complete the CLCS on their

own time.

Finally, the researcher was able to connect with middle and high school career and technical education directors who agreed to invite their teachers to participate and to incentivize students to get their parent's permission and participate in the study using class time and finishing on their own if necessary. Each teacher received a digital $20 Amazon gift card if more than 10 students in their class participated.

Participants

After coordinating distribution methods with the leaders of the student groups, all students received access to the CLCS via email. The participants represented public school students in the southeastern United States who were in grades 6 – 12. The students were asked to indicate their grade before they began; however, additional demographic information was collected at the end of the content-based questions. Each group provided participation information to everyone they served. In each instance, students were required to obtain parent's permission to access the CLCS.

The participants, all 6th – 12th grade, completed the instrument from October 2021 – January 2022. Of those who accessed the CLCS (n = 313), only 268 indicated their grade. The number of responses received per item ranged from 185 to 260, with an average of 215 responses per item, see Appendix C for the number of responses per item.

The demographic data at the end of the test, of primary concern for this research, were completed by gender (n = 162), number of books (n = 164), and race (n = 165). The majority of the students (n = 102) who provided their grade were in 8th grade, with a significant decrease observed in other grades, 6th grade (n = 15), 7th grade (n = 44), 9th grade (n = 26), 10th grade (n = 31), 11th grade (n = 33), and 12th grade (n = 17), see Table 19 for participant demographic data.

Table 19

Participating Student Demographics

	6th *n* = 15	7th *n* = 44	8th *n* = 102	9th *n* = 26	10th *n* = 31	11th *n* = 33	12th *n* = 17
[aRace]/Ethnicity n = 165							
African American	4	12	37	15	20	19	12
American Indian	1	0	4	1	2	2	0
Asian	1	2	7	1	1	0	0
Caucasian	2	4	16	4	2	6	1
Hispanic/Latinx	1	1	1	3	3	1	1
Indigenous	0	1	1	0	1	0	0
Native Hawaiian	1	2	1	0	1	0	0
Gender *n* = 162							
She/Her	3	8	26	14	20	13	4
He/Him	2	4	29	5	4	9	9
They/Them	1	5	3	1	1	1	0
Number of Books *n* = 164							
0-100	2	11	36	18	18	20	9
100-200	2	3	15	2	5	3	2
300 or more	2	4	7	1	2	0	2

Note.[a]30 participants provided more than one race.

The participants were asked "How would you like your friends to refer to you?" and they responded as follows: she/her (*n* = 103), he/him (*n* = 66), and they/them (*n* = 12). The majority of the participants, who provided their race, identified as African American (*n* = 124), with Caucasian (*n* = 40), Asian (*n* = 17), Hispanic/Latinx (*n* = 17), American Indian (*n* = 10), and Native Hawaiian and Indigenous combined (*n* = 8). Several students (*n* = 30) selected more than one race. In this study, the number of books in the home was used as a socioeconomic measure. The students' responses to the number of books in their home were as follows: 0 – 100 books (*n* = 125), 101 – 200 books (*n* = 39), and 300 or more books (*n* = 20). The results represent a somewhat diverse sample across the three demographic areas highlighted, though clear

majorities are present.

RO_2: Determine the Best Fitting Model for the Career Literacy Continuum Scale.

Model fit provides information on the extent to which data can be reliably interpreted. In addition, a fit to the model adds validity and indicates acceptable item and test results. The 1PL, 2PL, and 3PL models were estimated to determine which one best fit the data. The results were analyzed using the a priori criteria established in the methods section.

Exploratory factor analysis. The data were imported into STATA v.17 to perform the statistical analysis. IRT estimations can use all available estimations, however, for the EFA, observations with incomplete responses were deleted listwise. As a result, the initial EFA was run with observations (n = 164). A table summarizing all of the principal components analysis can be found in Appendix E. Because the data were binary, a tetrachoric correlation was run to create a matrix that could be used to run the exploratory factor analysis. As with most statistical analysis, the exploratory factor analysis is sensitive to sample size. The Kaiser-Meyer-Olkin (KMO) statistic provides a measure of sampling adequacy. The KMO is calculated for each item and the results range from (.28) which is unacceptable to (.93) a marvelous result. For these data, the overall KMO statistic (.83) is considered meritorious according to Kaiser's (1974) criteria. A table of the KMO results for all of the items can be found in Table 21.

The eigenvalues, scree plot, correlations, and percentage of variance explained by the factors were used to support the selection of factors to retain. The principal factor analysis reports the eigenvalues and the amount of variance accounted for by each factor. The eigenvalue for the first and second factors of the data were 13.87 and 2.71, respectively. Factor 1 accounted for .34 of the variance, with factor 2 accounting for .07. The scree plot, shown in Figure 5, is a visualization of the eigenvalues. It visually depicts the difference between the first and second

eigenvalues. Table 20 synthesizes the analysis of the EFA results used to suggest that the data represent a unidimensional model.

Figure 5

Scree Plot of Eigenvalues

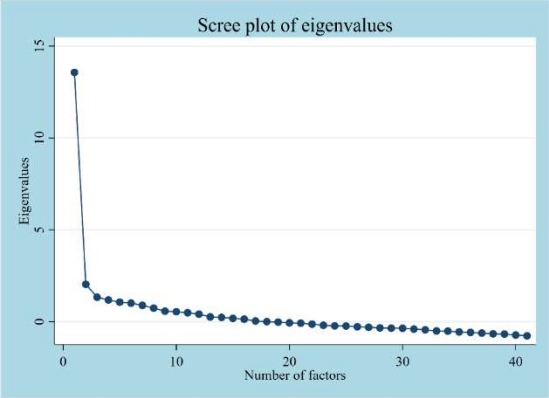


Table 20

Analysis of FA Results

Test/ Observation	Interpretation, a priori	EFA result	Outcome
Eigenvalue, first factor	High loading, first factor	Factor 1 – 13.87 Factor 2 – 2.71	1 factor
Variance, first factor	> 0.20, first factor	Factor 1 – 0.34 Factor 2 – 0.06	1 factor
Scree plot	Bend determines factor	1	1 factor

Local Item Independence

"Unidimensionality is sufficient to declare local item independence" (Warm, 1978, p.107). Because these data met the assumption of unidimensionality, it follows that it is also locally dependent.

Table 21

KMO Results by Item

Variable	KMO
GRITVALU2	0.28
SELARTG	0.49
CTSOLV	0.50
CTINTR2	0.53
CTTASK	0.57
AKEXPL	0.66
CTARQ2	0.67
CTREAD	0.68
GRITINIT	0.71
CTCRED	0.72
GRITEXPT	0.73
SELBIAS	0.76
AKMATH	0.77
CTLADS	0.77
AKSTEP1	0.79
CTCONS	0.79
CTDEC1	0.80
SELDISC	0.81
GRITPRST	0.83
GRITVALU1	0.84
GRITADV	0.84
SELREF	0.84
CTREAL	0.84
AKSTEP2	0.85
SELVIEW	0.85
CTINTR1	0.85
CTREL	0.86
SELAPP	0.86
CTDEC2	0.86
SELETIQ2	0.87
SELETIQ1	0.88
CTARQ1	0.88
SELELEM1	0.89
GRITDISC	0.90
SELELEM2	0.90
CTFACT	0.91
CTSKIL	0.91
SELELEM3	0.91
SELDVRS	0.92
CTMTCH	0.93
Overall KMO	0.83

Note. Table split into two columns for ease of viewing information on one page.

Monotonicity

The test of monotonicity was confirmed through observations of the data table and the directions of the item characteristic curve (ICC) after performing the estimations. Monotone data demonstrate the requirement that a higher ability level is required to answer more difficult questions. The 1PL model holds the discrimination the same for all variables. The 2PL model presents data on both the difficulty and ability level. A review of the ICCs after both estimations reveals one item that does not fit the assumption with the 2PL model estimation. For this item,

CTCRED, the probability of answering correctly decreases as the ability increases and is eliminated completely at Θ (ability) = 0 in the 2PL model. In other words, an individual with average or higher is estimated to answer incorrectly. Only the most able candidates, Θ = 3.28 or higher, have a chance of answering the item correctly according to the 1PL estimate. The characteristics of this line are visible in Figure 6 and Figure 7. The data are found in Table 23.

Table 22

Confirmatory Factor Analysis Results

	CFA results	
Fit statistic	Value	Model fit
Likelihood ratio		
model v. saturated	X^2 (779) = 1022.34, $p < 0.001$	*Significant
baseline v. saturated	X^2 (820) = 2336.67, $p < 0.001$	*Significant
Population error		
RMSEA	0.04	Good
90% CI, lower bound	0.04	Acceptable
upper bound	0.05	Acceptable
pclose	0.92	Acceptable
Baseline comparison		
Comparative fit index (CFI)	0.84	Reject
Tucker -Lewis index (TLI)	0.83	Reject
Size of residuals		
SRMR	0.07	Acceptable
CD	0.93	High

Figure 6

ICC 1PL CTCRED

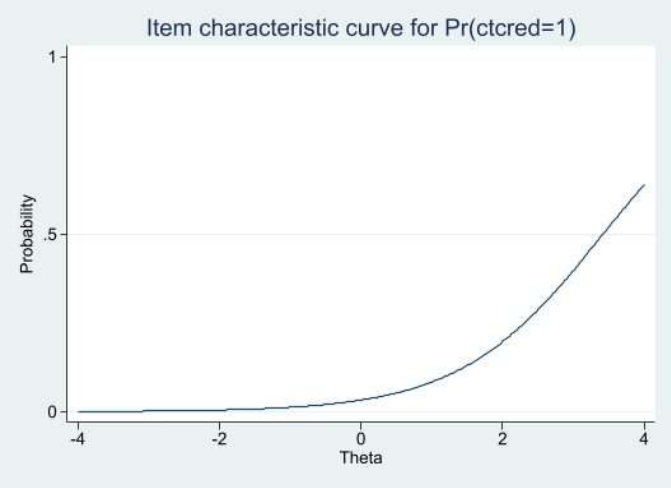


Figure 7

ICC 2PL CTCRED

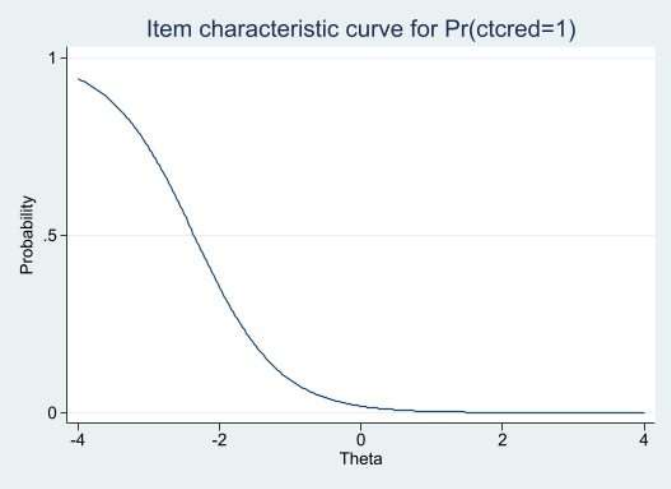


Table 23

1PL and 2PL Model Fit Estimation, sorted by 2PL increasing discrimination

	1PL[a]	2PL	
Item ID	Difficulty (b)	Discrimination (a)	Difficulty (b)
CTCRED	3.28	-1.99	-2.11
GRITVALU2	0.90	0.02	37.93
SELARTG	0.25	0.20	1.17
CTSOLV	1.59	0.28	4.93
CTTASK	0.91	0.42	1.87
CTINTR2	-0.43	0.42	-0.87
CTARQ2	1.05	0.45	2.04
GRITINIT	0.51	0.50	0.88
AKSTEP1	-0.38	0.62	-0.56
AKMATH	0.44	0.63	0.63
CTLADS	0.32	0.65	0.44
GRITEXPT	0.04	0.71	0.06
CTREAD	0.36	0.80	0.42
SELAPP	0.34	0.88	0.36
AKEXPL	-0.66	0.94	-0.70
GRITPRST	0.18	0.98	0.17
SELDISC	-0.47	1.02	-0.47
AKSTEP2	-1.20	1.06	-1.15
GRITADV	-0.41	1.07	-0.40
CTCONS	-0.01	1.07	-0.03
GRITVALU1	0.07	1.17	0.04
CTARQ1	-0.28	1.19	-0.27
SELBIAS	-0.10	1.23	-0.12
SELVIEW	-0.22	1.24	-0.22
SELETIQ1	-0.44	1.31	-0.39
CTREL	-0.23	1.38	-0.22
CTDEC1	-1.88	1.47	-1.47
SELELEM3	-0.36	1.63	-0.31
CTREAL	-0.58	1.72	-0.47
SELREF	-1.25	1.75	-0.92
CTINTR1	-1.82	1.77	-1.30
SELETIQ2	-1.17	1.79	-0.86
CTSKIL	-0.66	1.85	-0.52
CTDEC2	-0.40	1.90	-0.34
SELDVRS	-0.39	1.90	-0.32
CTFACT	-0.20	1.91	-0.20
SELELEM1	-0.89	1.93	-0.67
GRITDISC	-0.31	1.95	-0.28
CTMTCH	-0.58	2.14	-0.46
SELELEM2	-0.94	2.77	-0.65

Note. [a]1PL discrimination is 1.00 for all items.

Model Fit Estimation

Each IRT model provides a different level of data about the test items. The 1PL model estimates the items difficulty but holds the discrimination level the same for all of the items. The 2PL model includes a parameter for both difficulty and discrimination. Finally, the 3PL model provides parameter estimations for difficulty, discrimination, and guessing. In order to determine which model best fits the CLCS, a comparison of models can be used. Since Hambleton et al. (2001) indicated that guessing is common for school assessments, the researcher chose to estimate the 3PL model. For comparison data, the 1PL and 2PL models were also estimated. Both the 1PL and the 2PL models yielded results through the estimation; however, the 3PL model would not converge. Because the number of participants required increases with each parameter, the 3PL model needs significantly more observations (Sahin & Anil, 2017). The estimation of the1PL and 2PL models were successful and resulted in item- and test-level data, in addition to goodness of fit data that were used to compare the model fit. Reference lines are included on each graph at Θ = -1.5, 0, 1.5 to facilitate interpretation and comparison.

1PL Model Evaluation

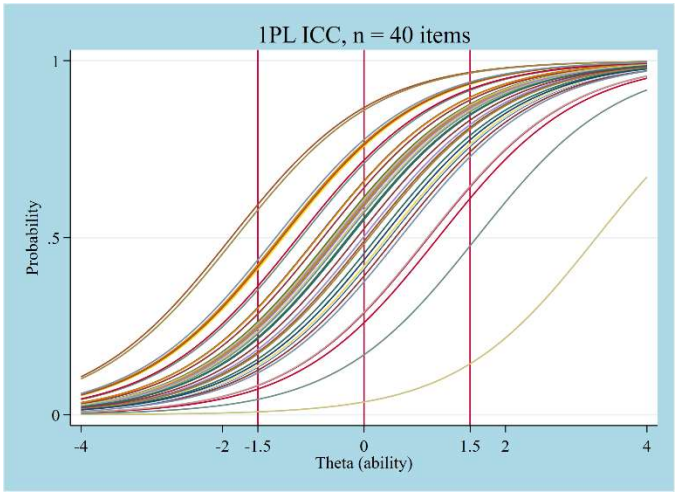
The 1PL model estimated the difficulty (b) of all items held constant at the same level of discrimination (a). This model was estimated with $a = 1.00$, which corresponds to a moderate level of discrimination according to Baker (2001). Baker (2001) also established the following levels for assessing difficulty: very easy, easy, medium, hard, very hard. The very easy item locations are less than Θ = -2.5 and very hard locations are more than Θ = 2.5, medium is 0. Applied to the CLCS, the data were considered as follows: easy to very easy (less than -4 to -2.5), medium to easy (-2.5 to -0.10), medium (-0.09 to 0.09), medium to hard (0.10 to 2.5), hard to very hard (2.5 to 4 or more). With discrimination (a) held at Θ = 1.00 (moderate) for all items,

the range of difficulty is Θ = -1.88 to 3.28. Table 23 shows item-level difficulty for the items estimated with one-parameter model.

Item Characteristic Curves. The 1PL item curves show a visual representation of the estimation data in Table 23. While the table provides an estimate at the location where an examinee has a 50 % chance of getting the answer correct. The curve provides data along the continuum from negative infinity to positive infinity. Figure 8 represents estimations from the 1PL model with discrimination a = 1.00 (moderate) and each items curve peaking at the difficulty listed on the table. The visual representation provides some context of the items in relationship to other items with regard to difficulty level. According to Baker (2001), a test that measures a wide variety of abilities the "item difficulty parameters should be spread uniformly over the ability scale and as widely as practical". Figure 8 below is a view of all of the items on the test collectively or refer to Appendix F for each item's individual profile.

Figure 8

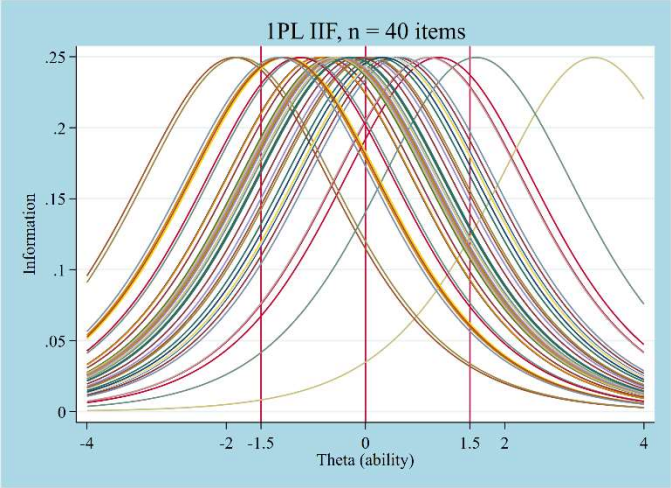
1PL ICC, all items



Item information function (IIF). The item information function tells the amount of information each specific item adds to the test. These data are aggregated to compute the test information function. Although individual item function values are rarely used independently, the plot of the data are helpful for optimizing the test. Ideally, test items chosen should provide the most information possible. In a 1PL model, because the discrimination (a) is held constant, in this case to $a = 1.00$, items information at varying theta levels are easier to locate visually. Figure 9 is a visualization of all items on the CLCS. The majority of items provide their highest levels of information in the Θ = -1.5 and 1.5 range.

Figure 9

1PL IIF, all items

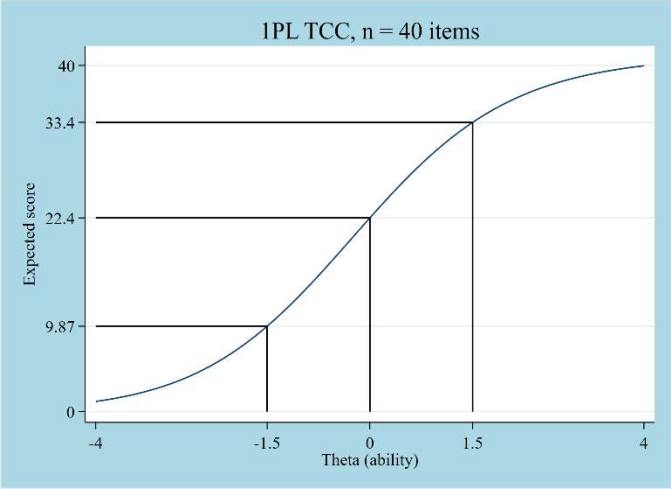


Test characteristic curve (TCC). The test characteristic curve provides additional reliability information by explaining predicted scores at specific theta (ability) points. Following the reference lines in Figure 10, at the given theta, an examinee would be expected to correctly answer Θ = -1.5 (9), 0 (22), and 1.5 (33), respectively. Beyond Θ = 1.5, the increase in expected

additional correct responses is more gradual and provides less information. Figure 10 shows the TCC with the expected number of correct responses at the above selected ability levels.

Figure 10

1PL TCC, Expected Number Correct Responses

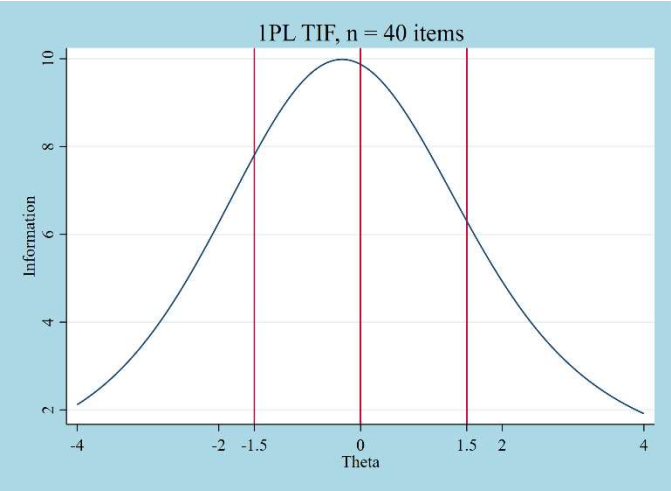


Test information function (TIF). The TIF plot provides a visual representation of the estimated accuracy, or reliability, of the test to determine a person's ability at a certain level. The test information function is a composite of all of the item information represented on the test as it is currently constructed. For a test that measures a broad range of abilities, Baker (2001) recommends a test information function that "is horizontal over the widest possible range" with the "maximum amount of information as large as possible" (p. 162). A test with maximum information will have a high peak over a certain level of theta. A test with a near horizontal test information function may provide information over a wide range of theta, but the information obtained will be limited. One test will not give large amounts of test information at more than one level of theta. Therefore, Baker (2001) notes that "the goals of a maximum amount of information and a horizontal test information function" are in conflict (p. 162).

For this test, the maximum information is gathered at Θ = -0.5. The test information decreases as the ability levels move further from the peak of information. The TIF is not symmetrical on both sides of theta. More information is provided at the lower ability levels than the higher ability levels which can be seen with its less steep slope, shown in Figure 11.

Figure 11

1PL TIF, all items



2PL Model Evaluation

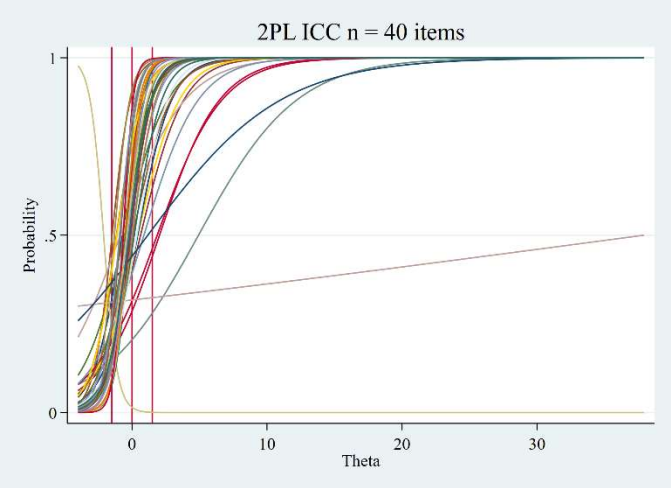
The two-parameter model estimates the discrimination (a) and difficulty (b) of a test. The range of discrimination (a) for the 2PL model, shown in Table 23, is a = -1.99 to a = 2.77 with four very low, six low, 16 moderate, three high, and 12 very high discriminating items. The difficulty levels range from b = -2.11 to b = 37.93 and the majority of the items were medium-easy to medium-hard. Table 23 shows the discrimination and ability estimates in the 2PL model.

Item characteristic curve (ICC). A visual inspection of the ICC for the 2PL model reveals outliers in this model's estimation. One item, already noted as a monotone item, has a higher probability of being correct at the lowest ability level. The item, *CTCRED*, is an example of a

nonmonotone item. Another item, *GRITVALU2*, has a difficulty of 37.42, which is significantly more difficult than the other items. The theta reference lines at -1.5, 0, 1.5, show that the majority of the items in the 2PL model are measuring abilities in that range. Figure 12 depicts the ICCs following the 2PL estimation.

Figure 12

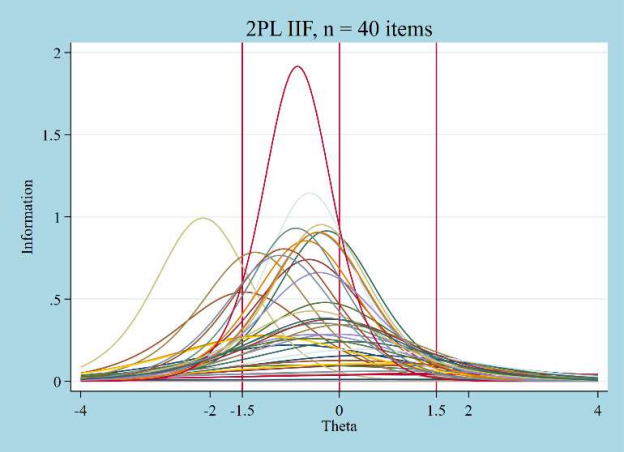
2PL ICC, all items



Item information function (IIF). The IIF for the 2PL model illustrates a variety of information available through all items on the test, with most information concentrated in the -1.5 to 0 ability range. One item, *CTCRED*, provides significantly more information than the others at Θ = 1.85. Another item, *SELELEM2*, is providing the most information at a lower ability level than the other test items at Θ = -2.25. The item, *GRITVALU2*, which also provided a problematic difficulty level, is noted in the IIF plot due to the relatively low information it is contributing to the test. Figure 13 shows the IIF for all items collectively, for context.

Figure 13

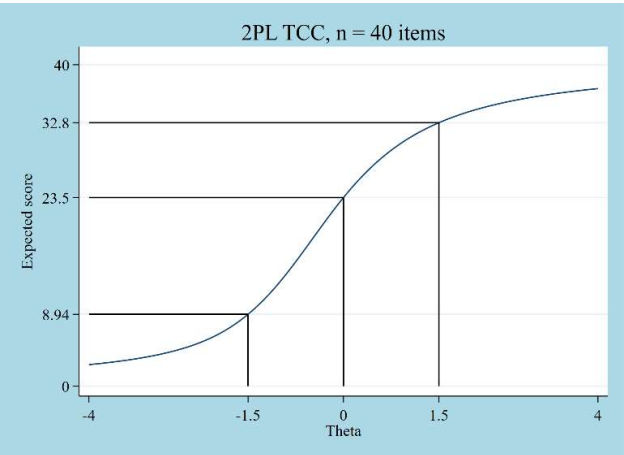
2PL IIF, all items



Test information curve (TCC). Examining Figure 14, at the specific theta reference lines, an examinee would be expected to correctly respond to Θ = -1.5 (9), 0 (23), and 1.5 (32). The curve flattens beyond Θ = 1.5. The most information is provided between Θ = -1.5 – 0. The number of correct responses increases nearly 200% which is more than any other ability segment. The highest number correct is estimated at around 35.

Figure 14

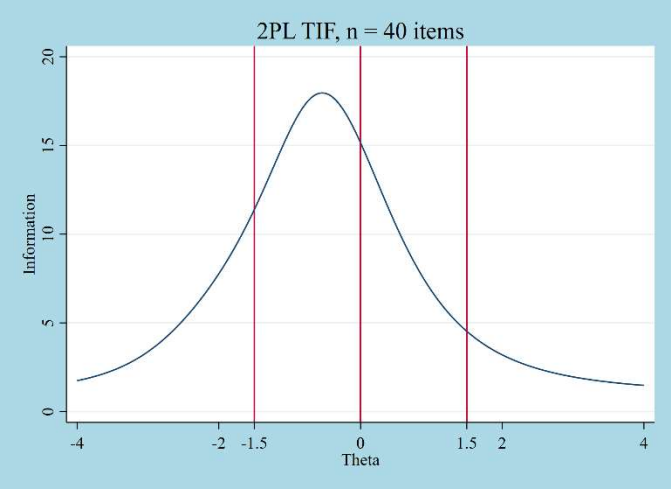
2PL TCC, Expected Number Correct, all items



Test information function (TIF). The 2PL model estimation obtains the most information at about Θ = -1.25. The reference lines here highlight the asymmetry of the TIF slope. There is more test information available in the below moderate range, Θ = -1.5 – 0, than the above moderate range, Θ = 0 to 1.5. Beyond Θ = 0, the information drops more steeply. The TIF provides information over the entire curve, with the extremes providing similar amounts of information. Figure 15 shows the 2PL TIF graph.

Figure 15

2PL TIF, all items



Comparing the Initial Models

The results of the likelihood ratio test comparing the equality of both models indicates a statistically significant result, $X^2(40) = 334.46$, $p > 0.001$. In this comparison we reject the hypothesis of equality of the models. The AIC and BIC are both goodness of fit estimates used in IRT modeling. The 2PL model has lower AIC (9520.58) and BIC (9800.70) numbers which indicate that it has the better model fit, which can be seen in Table 24. Based on the results of the goodness of fit (GOF) statistics, the 2PL model is preferable to the 1PL model for this dataset.

Table 24

Model Comparison Data, 1PL and 2PL all items

Model	N	-2LL (of the model)	df	AIC	BIC
1PL	225	-4845.53	42	9775.07	9918.54
2PL	225	-4678.29	82	9520.60	9800.70

Test Adjustment

In order to increase the reliability of the CLCS, the items were evaluated for removal. Because the initial model comparison indicated the 2PL as the best fit, the estimate data and graphs were reviewed to determine which items showed the most impact. The four items that were removed had very low discrimination values. In addition to the very low discrimination (a = 0.02), *GRITVALU2* was significantly more difficult than all of the other items with a location of b = 37.93. An examinee with the highest ability level has less than 50% chance of answering correctly. The item displaying nonmonotone behavior, *CTCRED,* was removed because an examinee had a higher probability of answering correctly at $\Theta = 0$. Additionally, it had a very low discrimination (a = -1.99) and a difficulty of b = -2.11. *SELARTG* was removed because the discrimination was very low (a = 0.20) even though it had a difficulty value of b = 1.17. The final item to be removed was *CTSOLV*, which also had a very low discrimination (a = 0.28) and a difficulty level of b = 4.93. After the items were removed, 36 items remained. Figures 16 and 17 show the characteristics and information of the removed items.

Figure 16

ICC Removed Items

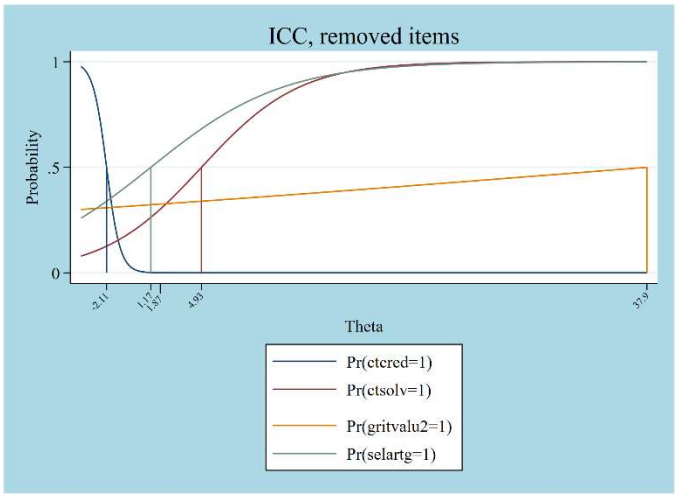
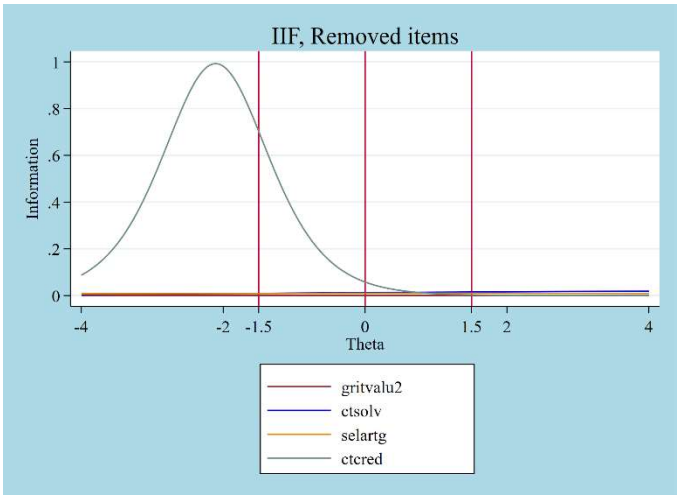


Figure 17

IIF removed items



2PL After Adjustment

The 2PL estimation data for revised instrument is shown in Table 25. The range of discrimination for the revised 2PL model is $a = 0.42$ to $a = 2.73$ with six low, 15 moderate, three high, and 12 very high discriminating items. Removing four items left one very hard item and no very easy items, see Table 26. The difficulty level ranges from medium-easy to medium-hard, $b = -1.49$ to $b = 1.99$. Table 25 shows the discrimination and ability estimates in the 2PL model.

2PL Item Characteristic Curve (ICC), after adjustment. An initial observation of the revised 2PL estimations is the graph of the which is appears more central to the x-axis, and the range of theta was clearly observed across the entire curve. The two easiest items stood out from the others, however, considered in context of the other items, they do not appear to represent extreme ease. The majority of item curves continue to fall within the range $\Theta = -1.5 – 1.5$, although the most highly discriminating items fall outside of that range. Figure 18 shows the ICCs after the 2PL adjustment.

Test Characteristic Curve (TCC). The TCC for the revised 2PL model estimates are similar to the results of the original 2PL estimation. The number of correct responses are expected to be $\Theta = -2.5$ (3), $\Theta = -1.5$ (7), $\Theta = 0$ (22), and $\Theta = 1.5$ (31), respectively. The additional reference, $\Theta = -2.5$, is included to demonstrate the amount of change over more levels of theta. The curve begins to flatten beyond $\Theta = 1.5$. The most information is provided at the below moderate range, $\Theta = -1.5 – 0$ where the expected number correct increases by 15. At the same time, the increase from $\Theta = 0 – 1.5$ represents the next largest increase in the expected number correct. Beyond $\Theta = 1.5$, the expected number correct flattens quickly. Figure 19 illustrates the intersection of selected expected scores at specific theta levels.

Table 25

Estimation After Test Optimization, Sorted by 2PL Increasing Discrimination

	2PL	
Item ID	Discrimination (a)	Difficulty (b)
CTTASK	0.42	1.87
CTINTR2	0.42	-0.87
CTARQ2	0.46	1.99
GRITINIT	0.49	0.89
AKSTEP1	0.62	-0.57
AKMATH	0.62	0.64
CTLADS	0.63	0.45
GRITEXPT	0.72	0.06
CTREAD	0.79	0.42
SELAPP	0.88	0.36
AKEXPL	0.93	-0.71
GRITPRST	0.97	0.17
SELDISC	1.03	-0.47
CTCONS	1.05	-0.03
GRITADV	1.06	-0.41
AKSTEP2	1.07	-1.15
GRITVALU1	1.19	0.04
SELBIAS	1.20	-0.12
CTARQ1	1.21	-0.27
SELVIEW	1.23	-0.22
SELETIQ1	1.28	-0.40
CTREL	1.39	-0.22
CTDEC1	1.44	-1.49
SELELEM3	1.63	-0.31
CTREAL	1.73	-0.47
SELREF	1.74	-0.93
CTINTR1	1.77	-1.30
SELETIQ2	1.80	-0.86
CTSKIL	1.86	-0.52
CTFACT	1.89	-0.20
CTDEC2	1.90	-0.34
SELDVRS	1.91	-0.32
GRITDISC	1.95	-0.28
SELELEM1	1.96	-0.67
CTMTCH	2.14	-0.46
SELELEM2	2.73	-0.65

Table 26

Comparison of Item Difficulty Before and After Optimization

	n = 40 items		*n* = 36 items
Level of Difficulty	1PL	2PL	2PL
Easy - Very Easy	2	1	
Medium - Easy	23	25	25
Medium	3	3	3
Medium - Hard	10	7	6
Hard - Very Hard	1	2	2
Very Hard	1	2	

Figure 18

2PL ICC After Adjustment

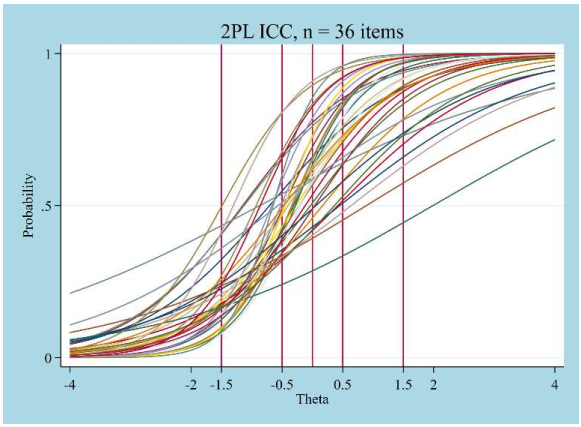
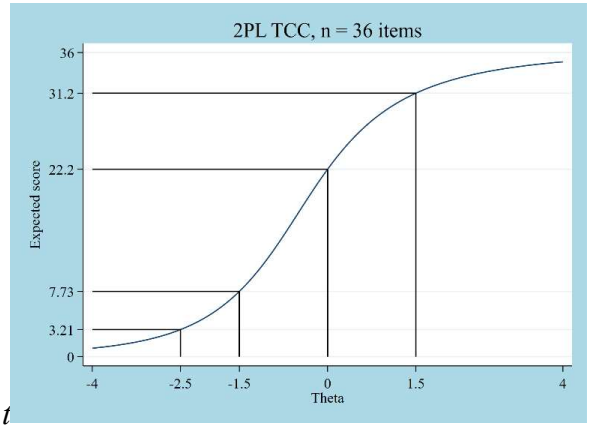


Figure 19

2PL TCC After Adjustment



t

RO_3: Demonstrate Reliability of the Career Literacy Continuum Scale.

Reliability statistics catalogued through the instrument development process provide users with an idea of the how well the instrument consistently measures the concepts it was intended to measure. The alpha coefficient KR20 is the preferred measure of internal consistency for dichotomously scored items. After removing the problematic items, 36 remained. The S-CVI was 0.95 after this adjustment. The KR20 coefficient was $\alpha = 0.90$, which meets the high consistency benchmark.

The process of differential item functioning (DIF) is used to check if the items apply satisfactorily across different types of groups: gender, age, SES, culture, language, etc. Additionally, item response theory estimation provides item and test information. The information function indicates an item's usefulness for assessing ability. The item information reports that item's or test's most precise ability measurement. The most reliability or precision is measured by the steepest curve. Every item's information is added together to determine the test information function. In the 2PL model, the item and test information functions are consistently steepest in the range of -1.5 to 0.

Differential Item Function (DIF)

The CLCS was designed to measure career literacy on a continuum from 6^{th} – 12^{th} grade. The range of scores for all students is 1 to 36, even with the most difficult item, *GRITVALU2*, removed. The data from the difficulty parameter estimates suggest that the majority of the items are easy. The profile of correct responses by grade supports that finding: see Table 28. More than 10% of students from grades 8, 10, 11, 12, or students who did not provide a grade, scored in the top tier. Students who did not provide a grade had the highest percentage of top tier scores. A majority of students in all grades scored in the 11-20 range, while the fewest number of students

scored in the top tier. This finding also supports the recommendation to develop a larger pool of items with a greater variety of difficulty. For this research, each correct answer received one point. While some items performed statistically different for different grades or numbers of books, no difference was exhibited by gender. Table 27 shows the items that illustrate DIF, by group.

Table 27

Differential Item Function by Group

	Demographic Group											
	7th		8th		9th		10th		11th		Books1	
Item	X^2	*p* value	X^2	*p* value	X^2	*p* value	X^2	*p* value	X^2	*p* value	X^2	*p* value
CTSKIL	3.87	0.05							4.55	0.03		
GRITVALU1			4.15	0.04								
CTLADS					6.04	0.01						
SELELEM3							4.74	0.03				
CTARQ1											3.83	0.05

Table 28

Number of Items Correct by Grade with Adjusted CLCS

		Correct responses			*n* in range				
Grade	*n*	% Total obs	low	high	0 - 10	11 - 20	21 - 30	31 - 40	% of Grade with 31+
6th	13	0.05	5	24	4	4	5		0.00
7th	37	0.14	3	31	19	14	3	1	0.03
8th	83	0.32	1	36	25	30	18	10	0.12
9th	25	0.10	7	33	3	10	9	3	0.12
10th	28	0.11	7	35	6	9	10	3	0.11
11th	30	0.12	4	33	8	8	9	5	0.17
12th	16	0.06	3	34	6	7	1	2	0.13
No grade	28	0.11	5	33	4	5	11	8	0.29

Note. [a] No grade selected by participant. *n* = number of students selecting that grade. Total number of observations is 260. Total possible score is 36.

2PL Item Information Function (IIF), After Adjustment

The IIF for the revised 2PL model provides another piece of evidence that illustrates a variety of information available through all items on the test, with most information concentrated in the Θ = -1.5 – 0 range, as it was in the original 2PL model. As examples, two items had peak information at Θ = -1.5, -1.4, respectively, while two others had peak information function just above Θ = 0. Relatively no information is added below Θ = -3.00 or above Θ = 1. Figure 20 shows the IIF for each respective item.

2PL Test Information Function (TIF), After Adjustment

The TIF for the revised 2PL model provides a curve similar to the original model. The curve is steepest at Θ = -0.90. The information value is drastically less outside the reference area, where the most test information is available. There is more test information is available at lower theta levels. The reference line at Θ = -0.5 illustrates the ability level location at which the most examinee information can be obtained. Figure 21 shows the TIF for the 2PL model after the items were removed.

Figure 20

2PL IIF After Adjustment

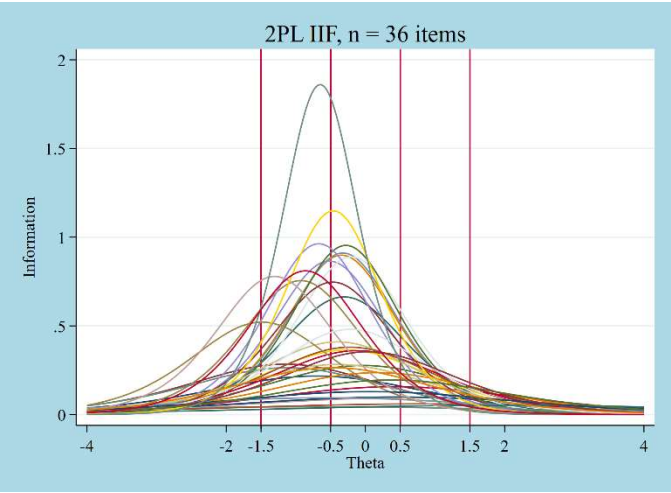
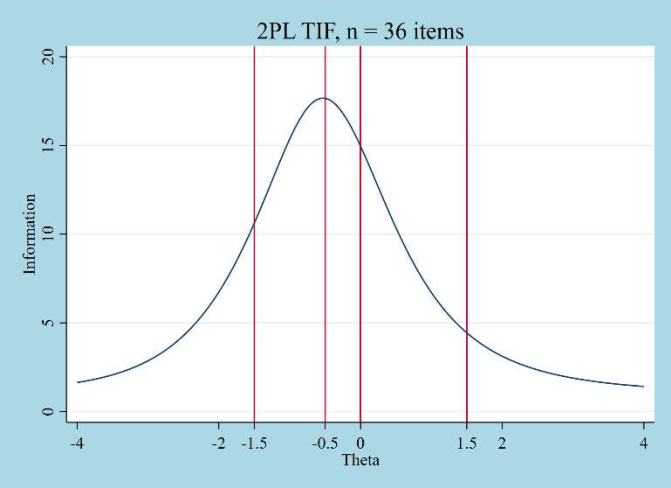


Figure 21

2PL TIF After Adjustment



CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Chapter 1 provided background information on the problem and established the need for an instrument to measure career literacy. Chapter 2 introduced literature important to understanding how career literacy has evolved over time, including influences on career decision making and approaches to supporting students in their development of these complex skills. Chapter 3 established the procedure for creating the Career Literacy Continuum Scale and analyzing the data collected from the field test administration. Chapter 4 presents findings from the creation, administration, and analyzation of the CLCS field test data. Finally, this chapter puts the findings in context of the original problem, suggests practical implications to serve educators in the use of the CLCS, and offers recommendations for future research and improvement to the concept and measurement of career literacy.

Summary of the Study

The purpose of this research was to develop a scale be used to determine adolescent's career literacy. Career literacy is a person's ability to read, understand, evaluate, and make decisions based on career-related information (Valentine & Kosloski, 2021). As students matriculate through school, they are required to make choices like selecting courses and programs of study that can impact their postsecondary options (Marcionetti & Rossier, 2017). It is unlikely that the consequence of choosing a course or program of study has a negative impact; however, given the rising cost of postsecondary education and the statistics surrounding its completion (NCES, 2019; Pell Institute, 2018), a clear understanding of career entry requirements could provide a positive financial impact for adolescents and their families (Lapan et al., 2017).

The Career Literacy Continuum Scale (CLCS) was designed to provide data that will support conversations about experiences and skill development necessary for adolescents to make informed decisions about their next steps. By aligning results from the CLCS to career readiness skills, which are incorporated in some commercial packages and curriculum already, educators may be able to more meaningfully recommend specific experiences or facilitate discussions based on their students results.

The instrumentation research design for this study followed the process outlined by Devellis (2017). Key milestones in this process include item generation, expert review, and pilot testing to provide validity data. The field test administration, another significant milestone in this process, collected data that were analyzed using the item response theory to determine model fit, reliability statistics, and additional validity evidence. Using these results, the research questions are answered in the following pages. Further, from these results, the researcher includes some conclusions, suggestions for practical application, and recommendations for future research.

A summary of the relevant findings for each objective are provided as context for the interpretation of the objective's fulfillment through this research. The following goal and objectives were established to guide this instrument development research.

Research goal: Develop a valid and reliable measure of students' career literacy skills called the Career Literacy Continuum Scale.

Research objectives:

RO_1: Demonstrate validity of the Career Literacy Continuum Scale.

RO_2: Determine the best fitting model for the Career Literacy Continuum Scale.

RO_3: Demonstrate reliability of the Career Literacy Continuum Scale.

Summary and Synthesis of Results (to RO)

RO_1: Demonstrate Validity of the Career Literacy Continuum Scale.

The first stage of developing an instrument is to fully conceptualize the latent trait (Devellis, 2017). To establish criteria and content necessary for the development process, the researcher used the literature to clarify the concept and develop the initial items (Devellis, 2017; Viswanathan, 2005). After developing items with a basic test map indicating one question per concept in collaboration with relevant professionals, the items were presented to subject area and test development experts for review. The results of the review were included as evidence to demonstrate validity.

The argument for an instrument's validity can be established by using both qualitative and quantitative data points. The instrumentation research design incorporates the use of a structured process as validity evidence (James, 2016). Career literacy skills and concepts from the literature were a starting place for the initial item development (Valentine & Kosloski, 2021). After the items were developed, they were evaluated by a panel of experts using an established process for item- and test-content validity index (CVI) scoring (Polit & Beck, 2006). As a result of the CVI scoring, three items were removed, and seven items were revised. All of the experts provided comments about the face validity of the CLCS that were used to make changes to the instrument in preparation for the pilot test administration.

After receiving authorization to conduct research using human subjects from the Institutional Review Board, a pilot test administration was conducted with a small convenience sample with participants mirroring the intended field test population. The researcher contacted parents who were previously known associates to increase the possibility for a feedback loop on the largely electronic process if concerns arose. The sample parents were comfortable using

Qualtrics to provide consent to their students' participation, and the researcher was able to discover and correct a material dissemination issue. Although the research process included interviews with select pilot study participants, the results of the interviews were not substantially informative. All pilot participants were invited to share concerns and questions on the actual test. Very few responses were during the test administration, though one important suggestion was given. Another noteworthy concern about an item was reported by a parent. No problems were detected with the examinees ability to respond to items.

The S-CVI score for the entire scale, prior to the field test administration and analysis was 0.92. This score is considered strongly relevant. After the item calibration process and removing 4 items, the CVI for the scale 0.95 was still considered strongly relevant. This information supports the content validity of the CLCS (Polit & Beck, 2006).

RO_2: Determine the Best Fitting Model for the Career Literacy Continuum Scale

A model's fitness for the analysis method provides another layer of validity. The goodness of fit statistics determine the accuracy with which the model estimates the data. In order to appropriately use the item response theory (IRT) for analysis, the data are assumed to be unidimensional, locally independent, and monotone (Claro et al., 2015; Cudeck & Henley, 1991; Hambleton & Swaminathan, 1985).

Tests to Confirm Required Model Assumptions

Both exploratory and confirmatory factor analyses were run to provide evidence of unidimensionality. Results produced from both measures indicated the presence of one dominant factor, using the a priori criteria established in the literature. The first factor for of the EFA had an eigenvalue of 13.87 while the second factor had a value of 2.71. It accounted for .34 of the variance which exceeds the .20 required in the literature (Hambleton et al., 2000). The scree plot

depicted the same large distinction between the first and second factors. The CFA produced significant results with the X^2 goodness of fit tests. The CFI (0.84) and TLI (0.83) indicated the rejection of model fit. At the same time, the RMSEA (0.044), SRMR (0.066), and CD (0.929) results were acceptable or high. The results of the CFA provide inconclusive evidence for unidimensionality. However, because the results of the EFA met the stated thresholds the data were considered to meet the unidimensional criteria, which is supported by Hambleton et al. (2000).

According to Warm (1978) and Paek and Cole (2020), unidimensional data meet the qualification of local independence. The item characteristic curves (ICC) presented the clearest evidence for evaluating the assumption of monotonicity. The reverse curve of one item depicted a high probability for a correct answer with low ability which did not meet the expectation of monotonicity. This item was removed from the test and the remainder of the items met the assumption. Based on the results of these tests, the CLCS was considered to have met the assumptions for using the IRT model for estimations.

Model Fit Evaluation

A proper model fit provides additional validity to the interpretation of the estimation results. After confirming that the assumptions were met, the data were modeled using 1-, 2-, and 3-parameter estimations (1PL; 2PL; 3PL) for comparison of model fit (Edelen & Reeve, 2007; Immekus et al., 2019). The 3PL model would not converge to produce any statistics and was removed from further model comparison. The size of the sample may have impacted this result. The 1PL and 2PL model estimations were analyzed to determine whether the models were equal, or if one model was favored over another. The X^2 goodness of model fit statistics, compared

using the AIC and BIC statistics, resulted in favoring the 2PL model over the 1PL model (Maydeu-Olivares, 2013).

Test Specification

The advantage of test design using IRT analysis is the ability to item and test information to design a measure specific to the intended examinees (Baker, 2001; Hambleton et al., 2000). Therefore, a test specification is required prior to analyzing results and making decisions about the best items for the individuals being examined which, for the CLCS, are adolescents (Baker, 2001). This makes test specification critical to the process.

This version of the CLCS was initially conceptualized to measure the latent trait of career literacy in adolescents, which was described as the 11 - 19 age range, or 6^{th} -12 grade. A single test designed to measure such a broad range of ability is unlikely to be practical as it would have to have a very large number of items. A narrower definition of the target students for the CLCS could have been more helpful for providing a more concise reliability analysis.

Test Construction after Model Selection

The CLCS items were estimated first to collect data about the goodness of model fit for the purpose of selecting a model to analyze. During that process, item- and test-level data were generated using both the 1PL and 2PL models. Evaluating the data and item characteristic curves (ICC) for both models revealed four problematic items. The first item was removed during the test of monotonicity because it had a reverse curve. Three additional items were removed because they had very low discrimination and were too easy or hard, according to the criteria established in the literature.

After removing the four problematic items, the 2PL model was estimated for a second time. The item characteristic curves (ICC) and supporting data provided evidence for evaluating

the items' difficulty, and the 2PL individual levels of discrimination were also included. Using the difficulty measures established in the literature, the range of items met the test specifications. The 2PL model provides a discrimination value for each item which, with the exception of six items, ranged from moderate to highly discriminating.

RO_3: Demonstrate Reliability of the Career Literacy Continuum Scale.

Reliability data for an instrument provides users with an empirical reference of its ability to provide consistent data on the measured trait. As with validity, an instrument builds a profile of reliability data. The reliability of the CLCS is being measured using item- and test-information function data, test characteristic curve (TCC) data, and alpha coefficient data from the KR20 and Cronbach's alpha statistics.

The alpha coefficient provides reliability information recognized across methods. The Cronbach's alpha coefficient is one way to measure an instruments internal consistency. The KR20 is an alpha coefficient calculated specifically for dichotomously scored items. After removing the four items, both the Cronbach's and KR20 alpha coefficients were $\alpha = .91$ which represents high consistency.

Item- and Test-Characteristic and Information Functions

Using the IRT analysis, each item produces data and associated graphs that represent its measurement properties and the information it contributes to the overall test. The test characteristic curve and the test information function are representations of the collective characteristics and information from each item included on the current test. Overall, the CLCS provides the most information (reliability) for examinees with less than average ability levels.

Differential Item Functioning (DIF)

Tests are often at fault of providing more or less data based on demographic criteria. A differential item functioning (DIF) analysis was run on the items to determine if any items performed statistically different considering gender, grade, or socioeconomic status (SES), measured in terms of books in the home. The results of the DIF analysis indicated no statistically significant connection between gender or SES. A limited number of items had bias in certain groups.

The results of this study indicate that the items on the CLCS range in difficulty, although there were a great deal more easy items than hard items. The original research on career literacy indicates skill acquisition across the range of secondary school and beyond (Valentine & Kosloski, 2021). Therefore, there was no expectation that students would score perfect or even strongly because the skills are acquired throughout their secondary learning experience. However, it was assumed that students at higher grades would perform better because it is likely that they would have some personal, paid work experience or work-based learning experience. The differential item functioning tests (DIF) did not produce any statistically significant results supporting this assumption. The majority of the initial field test students were in the eighth grade, so the small number of 11^{th} and 12^{th} grade examinees may have influenced this finding. At the same time, as a result of the Covid-19 pandemic, this researcher speculates that restrictions and the associated risk of working in certain positions may have impacted the normal opportunity for work experience, even for older students (Mann et al., 2020).

Limitations Experienced

At the beginning of the study, the researcher identified limitations concerning the generalizability of the study's results. The primary limitations noted were the assumption of similarity between the study participants and the general population. In addition to the known

limitations listed in the introduction of the study, additional limitations were experienced during the study, one of which was a change in question formatting. The original plan for question design included multiple types of items to address skills that were not best measured with multiple-choice.

Patten (2016) notes that effective questionnaire type research is most effective when the target population is considered throughout the design of the research and providing clear incentives for participation is important to obtaining participation. The researcher made decisions to use formats that would be most accessible to all potential participants, which meant that multiple-choice questions were solely used for this administration. The majority of the study's participants were asked to complete the instrument on their own time. The researcher had no way to provide incentives to participants, as personal data were not collected. The two factors combined, question formatting and student motivation to participate, may have led to the large number of incomplete observations.

One of the main concerns in scale development is the ability to generalize the results to other examinees. The item response theory is advantageous over the classical test theory in this regard because the estimations are provided about the item or test rather than the individuals taking the test at the time (Crocker & Algina, 1987). To mitigate this, the researcher took care to make sure that the model assumptions were met prior to beginning the analysis and that a diverse group of participants were recruited.

The Covid-19 pandemic severely restricted access to the target participants. At two of the research sites, an approval was given to proceed with the research after internal reviews. Both sites commented on the less than favorable likelihood of receiving many parental permissions and therefore were reluctant to commit to having the field test completed during regularly

scheduled meeting time. Instead, participating students were required to complete the CLCS on their own time because the school districts were concerned about taking away time from instruction due to the amount of time lost the previous year due to Covid. This impacted the number of students who completed the entire instrument. As an example, at one site, the parental permission form was accessed 115 times which granted access to 55 students, of which 18 completed some portion of the CLCS and 12 fully completed the test. The results at the second site were similar. While the researcher continued to recruit groups and organizations to complete the test and gather the appropriate sample sizes, eventually locating a partner who was willing to incentivize students to complete the CLCS on their own time, was most critical to participant recruitment.

IRT uses all available data, but some other statistical analyses procedures do not. Even though more than 300 responses were received, after STATA removed incomplete responses listwise, there were 164 available for the EFA and CFA analysis. IRT analysis uses all available data for the item, at the same time, a non-response is counted as an incorrect response (Finch, 2008; Stover et al., 2019). Because incorrect responses factor into an item's difficulty assessment, the number of items without responses could have made an impact on the model's assessment.

Implications

"Critical literacy has to do with an ability to challenge the status quo of the social order and identify meaningful action to help shift power imbalances" (Kumasi, 2011, para 4). This is especially true of career literacy as careers impact nearly every decision in an adult's life (Diemer et al., 2020). For different reasons, some students need more support in their preparation for postsecondary achievement, though it is noted most especially for marginalized populations

(Holland & Deluca, 2016). Postsecondary education is not feasible for some students for a variety of reasons like lack of interest in school or training, poor academic experiences, and the expense of attendance (Eshelman & Rottinghaus, 2015; Holland & DeLuca, 2016; Plank & Jordon, 2001). Considering the changing workforce, expense of postsecondary education and training, and the dropout rate, appropriate interventions are necessary to change the status quo (Elder, 2015; Symonds et al., 2011).

Theoretical Implications

The Social Cognitive Career Theory highlights the impact that an individual's environment has on their career goals and expectations (Lent et al., 1994). A tangible understanding of the impact may be helpful in providing direct intervention that leverages the available support and negates the unhelpful influences (Bandura et al., 2000; Balfanz, 2012; Guillon et al., 2004; Tang et al., 2008). Further development of the career literacy concept, to extend beyond adolescents, and this current version of the Career Literacy Continuum Scale, may prove useful to those providing career development support for individuals in a variety of career transition stages. The concept of career literacy, as defined for this study using a complex approach like health information literacy, is relatively new. As career literacy exists along a continuum with new levels of skills needed as ones' career advances, it may be considered alongside Super's (1953) life-span approach to career development.

Legislative Implications

The United Nations established decent work and economic growth as its eighth global goal (United Nations, 2020). Similarly, Perkins V legislation (2018) directs educators to create an increase in career-related curricular connections and employability skills for youth, which is one indicator of the burgeoning importance of career development to global and national

communities. As states, in this case Virginia, continue to explore their students' preparation, they have legislated curricular requirements including the direct investigation or study of careers beginning in middle school, in addition to the academic and career plan (College & Career Readiness, 1997/2019). Although career investigation is a curricular requirement, currently no standard course curriculum or standard of learning (SOL) measure is developed. In the same way that personal finance has become a graduation requirement to make sure that students have some financial literacy, career literacy could become another requirement designed to increased postsecondary success. In this case, CLCS could be implemented as both a diagnostic and evaluative measure for schools and programs implementing programming. Using results from the CLCS, district to district comparisons could be made resulting in the ability to prioritize funding for projects like curriculum development and impactful programming like summer work, as necessary (Requirements for Graduation, 1997/2018).

Interventions to Reduce Career Indecision

Curricular Implications. Career goals, aspirations, and efficacy are integral to academic success because they lead to increased engagement (Castellano et al., 2011; Fredericks et al., 2004). Integrating career literacy skills into various curricular areas might mean increased academic achievement for all students, not just those without a career role models at home while at the same time helping students to make connections between their current studies and their future. Marcionetti & Possier (2017) add readiness for career exploration as important considerations and authentic integration of career literacy skills into the curriculum may lead to stronger readiness.

Results from the CLCS or the actual list of career literacy skills can be incorporated into curriculum or learning objectives strategically. An example of strategic implementation includes

creating vertical and course level articulations of career literacy skills by subject area. This may improve relevance, especially if students interact with concepts across different courses and in different ways. Further, intentional integration at the subject planning level can create more authentic opportunities for teachers to facilitate connected learning experiences during their instruction. As an example, a teacher may incorporate an activity with complex rules to follow by encouraging students to engage with each other while giving and following step-by-step written or oral instructions. An approach like this provides students with consistent exposure to the concepts and experiencing them in more than one way to aid in transferability.

Counseling Implications. The literature offers several examples of the importance of personally relevant and self-directed career exploration (Kuijpers et al., 2011; Tracey, 2011). The most recent Perkin's legislation declares the necessity of creating interdisciplinary opportunities to explore associated careers beyond those prescribed in career and technical education courses (Strengthening CTE, 2018). Middle school counselors indicated the importance of using Career Pathways to begin career conversations with their students (Advance CTE & American School Counselor Association, 2018). Using career literacy skills or the results from the CLCS may be a way to initiate conversations with students and create better informed individualized career plans. Counselors across all age groups noted the varying demands on their time which leaves them with limited time for career development with individual students (Beale, 2001). Trends from individual or school wide CLCS data may provide counselors with the data they need to use their time more effectively by investing their time in targeted programming and planning rather than generic school-wide events that do not support student growth in career decision making (Beale, 2001; Choi et al., 2015; Eaton, 2020).

Huang & Hsieh (2011) note the importance of using the results of career measures to provide guidance for students. Beale (2001) argued that school counselors often use the instruments they connect with in their degree matriculation. The career literacy skills were written with practitioners in mind in order to facilitate their use in everyday practice (Valentine & Kosloski, 2021). Practically speaking, school counselors could choose to use sections of questions from the CLCS, or just the career literacy skills, to frame their planning or discussions with students in everyday, relevant language, all of which could support more authentic integration of career conversations in multiple school settings.

***Family Partnership Implications*.** Although influence begins to shift from parents to friends in early adolescence, parents are still the most significant career influence (Davis-Kean, 2005; Olle & Fouad, 2015; Rodriguez-de-Dios et al., 2018). Due to the importance one's career holds in life, care should be taken to make the best preparation. Parental influence extends from academic and work philosophy to modeling and developing career expectations. Results from the CLCS can become an important tool for developing partnerships with parents with the aim of support students career development with multiple approaches.

Recommendations for Future Research

Item Development

Although the item development process was undertaken in an ad hoc, collaborative fashion, inviting ideas from experienced professionals in a variety of industries, a more formal process may have been helpful during the item generation phase. Recruiting a team of individuals trained to write test items would have helped to provide a larger bank of items to measure more of the career literacy concepts. Additionally, a larger item bank may have yielded

more questions with a greater variety of difficulty levels. At the same time, the nature of this research precluded the invitation of paid assistance for this task.

Scoring and Additional Development

Gottfredson (1981) suggests that students begin to solidify their career choices beginning in adolescence. Others (Kuijpers et al., 2011; Savickas, 1994) recommend relevancy as a criterion for career development. Connecting these two ideas, the CLCS can be further developed to recommend specific and relevant areas of improvements for students as they prepare to make career-related decisions. Currently, the test is designed to produce a number of correct responses, not a score. As a result, quantitative research could be conducted to develop a weighted scoring algorithm so that correctly answering more difficult items will result in a higher score. Additionally, future qualitative research could be conducted to provide a basis for score results that include recommend targeted, accessible experiences that would build adolescents' career literacy skills as part of the results. It is the hope of this researcher that this concept would be embraced broadly, not necessarily as an authoritative stance, but rather to raise awareness of the links missing between K-12 matriculation and postsecondary career fulfillment.

Modified Instrument or Protocol

As mentioned earlier, the field test was conducted with the researcher as a very distant partner as a result of the Covid-19 pandemic. While multiple-choice tests are a popular form of assessment for students, a number of the career literacy concepts might be better measured using other formats. As assessment methods become less standardized, the likelihood of being incorporated might decrease; however, developing an interview or observation protocol for counselors or teachers could be helpful for assessing topics that are less completely measured

through multiple-choice, like some of the social emotional learning topics.

Students who receive special education services, prescribed through an Individual Education Plan (IEP), are required to begin participating in transition planning at age 14 (Forte et al., 2017). Additional instrument development research to develop a form of the CLCS appropriate for students with differing access needs like visual, intellectual, and language, might provide useful information to the community of stakeholders. The addition of specific, skill-building experiences could make a meaningful improvement to transition plans and postsecondary planning.

Additional formatting considerations may make the test and results more relevant to the students and their support system. One option would be to create a battery of tests that provide more information at above-average ability levels, specifically above $\Theta = 0$, which are not thoroughly measured with the current version of the CLCS. To do this, several, more difficult items need to be developed that will provide high levels of information and discrimination at that level.

A number of instruments are developed in a shorter form at some point after their development (Ho & Sum, 2018). Another formatting consideration is to change the presentation of the CLCS from one long instrument to a series of shorter instruments. For example, using the career literacy skills connected to the themes presented by Mishkind (2014), each of the areas could be a separate instrument. This change may have a positive impact on student's ability to focus throughout the duration of the CLCS and reduce test-taker fatigue.

Finally, with regard to the actual instrumentation, the researcher envisions a gamified version of the digital assessment that looks less like a classroom-based assessment and more like a game, available in other languages. Assessing the student's choices using a version of the

CLCS that does not require reading may keep students more engaged through its completion. Additionally, it may provide a more accurate assessment of the career literacy trait because reading ability would not be as strongly reflected in the number of correctly answered items.

Additional Field Testing Specifically with Late-Age Adolescents

As career development continues to be a lifelong concern for many adults who do not have the fortune of beginning and ending in the same company or career field, as is the case with most generations after the baby boomers (Gordon, 2014), developing career literacy skills for each stage of career transition could be helpful. Each stage of career development brings about its own challenges to entry (Choi et al., 2015). Additional qualitative and quantitative research should be conducted to identify or categorize those transitions, assess the needs at each level, determine the most impactful type of support and the ways individuals might access it, and develop that support for everyone who needs it. The United Nations (UN, 2018) council acknowledged the global necessity for career development and training for youth. In some countries, training for a career constitutes hardships. It would therefore be imperative that the most strategic planning and opportunities be made available for these individuals, in particular.

Conclusion of the Study

A measure of career literacy can become an objective way to level the playing field for students who are encountering career-related information without strong support from their families. Once a student's career literacy is measured, steps can be taken to provide appropriate interventions and experiences to increase it and positively impact their career choice behaviors. The impact of measuring career literacy is the power of determining specifically what a student will need to surpass the influence of any negative contextual affordances. With student specific information at hand, parents, educators, and the students themselves can work to develop the

skills necessary for accessing and understanding all the available career opportunities. This may give students a chance to move beyond their current circumstances and receive the benefits that come along with that life improvement. A career literacy measure provides a foundational data set for educators and families to determine and coordinate strategies and opportunities necessary to help students move along the continuum. Every positive step along the continuum should mean better chances for post-secondary success.

Even though librarians and other educators can help students locate and organize career-related research, they may or may not be able to understand and interpret the information they find. Career literacy can be impactful if it means that more young people are able to knowledgeably explore and consider all the career options available to them impacting their future earning potential. This may be particularly helpful for young women and those who support their career development. The results from a career literacy assessment will provide educators, families, and students with the data necessary to create a career exploration process that may, more effectively, impact a student's postsecondary trajectory. Evaluation of a student's career literacy would be a precursor to understanding the results of many of the other efficacy and interest measurements already being implemented.

REFERENCES

Advance CTE & American School Counselor Association. (2018). The state of Career and Technical Education: Career advising and development. https://cte.careertech.org/sites/default/files/files/resources/State_of_CTE_Career_Advising_Development_2018.pdf

Al-Bahrani, M. A., Allawati, S. M., Abu Shindi, Y. A., & Bakkar, B. S. (2020). Career aspiration and related contextual variables. *International Journal of Adolescence and Youth, 25*(1), 703–711. https://doi.org/10.1080/02673843.2020.1730201

American Association of School Librarians. (2018). *Definition of an effective school library*. http://www.ala.org/aasl/sites/ala.org.aasl/files/content/advocacy/statements/docs/AASL_Position_Statement_Effective_SLP_2018.pdf

American Institute for Research. (n.d.). *Accountability metrics*. State profile comparison. College and Career Readiness and Success Center. https://ccrscenter.org/ccrs-landscape/state-profile/compare-states

American Institute for Research. (n.d.). *Career exploration and career plans*. State profile comparison. College and Career Readiness and Success Center. https://ccrscenter.org/ccrs-landscape/state-profile/compare-states

Arnold, J. (2004). The congruence problem in John Holland's theory of vocational decisions. *Journal of Occupational and Organizational Psychology, 77*(1), 95–113. https://doi.org/10.1348/096317904322915937

Association of Career and Technical Education. (2006). Reinventing the American high school for the 21st century: Strengthening a new vision for the American high school through the

experiences and resources of career and technical education. https://eric.ed.gov/?id=ED524837

ACARA (2012). National assessment program - ICT literacy years 6 & 10 report 2011Sydney, Australia: Australian Curriculum, Assessment and Reporting Authority. http://www.nap.edu.au/verve/_resources/nap_ictl_2011_public_report_final.pdf.

Akaike, H. (1974). A new look at the statistical model identification. IEEE Transactions on Automatic Control, 19, 716–723. doi:10.1109/ TAC.1974.1100705

Baker, F. B. (2001). *The basics of item response theory*. https://eric.ed.gov/?id=ED458219

Balfanz, R. (2012). *Overcoming the poverty challenge to enable college and career readiness for all*. The Johns Hopkins University.

Ball Foundation. (n.d.). Career literacy. https://careervision.org/career-literacy/

Bandalos, D.L., & Finney, S.J. (2010). Factor analysis: Exploratory and confirmatory. In G.R. Hancock & R.O. Mueller (Eds.), *The Reviewer's Guide to Quantitative Methods in the Social Sciences* (pp. 93-105). Routledge.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual review of psychology*, *52*(1), 1-26. https://doi.org/10.1146/annurev.psych.52.1.1

Bandura, A. (1986). *Social foundations of thought and action*. Prentice-Hall.

Bandura, A., & Walters, R. H. (1977). *Social learning theory* (Vol. 1). Prentice-Hall.

Bann, C. M., Kobau, R., Lewis, M. A., Zack, M. M., Luncheon, C., & Thompson, W. W. (2012). Development and psychometric evaluation of the public health surveillance well-being scale. *Quality of Life Research*, *21*(6), 1031–1043. https://doi.org/10.1007/s11136-011-0002-9

Bartlett, J., & Domene, J. F. (2015). The vocational goals and career development of criminally involved youth: Experiences that help and hinder. *Journal of Career Development, 42*(3). https://doi.org/10.1177/0894845314547269

Bartolucci, F., Bacci, S., & Gnaldi, M. (2015). *Statistical analysis of questionnaires: A unified approach based on R and Stata* (Vol. 34). CRC Press.

Barton, P. E., & Coley, R. J. (2011). The mission of the high school: A new consensus of the purposes of public education? *Educational Testing Service*, 1–42. www.ets.org/research/pic

Beale, A.V. (2001). Emerging career development theories: A test for school counselors. *Professional School Counseling, 5*(1), 1-5. https://odu-primo.hosted.exlibrisgroup.com/permalink/f/1f1i7p5/TN_cdi_proquest_journals_213438471

Benson, J., & Clark, F. (1982). A guide for instrument development and validation. *American Journal of Occupational Therapy*, *36*(12), 789-800. https://doi.org10.5014/ajot.36.12.789

Bennett, D., & Robertson, R. (2015). Preparing students for diverse careers: Developing career literacy with final-year writing students. *Journal of University Teaching & Learning Practice, 12*(3). http://ro.uow.edu.au/jutlphttp://ro.uow.edu.au/jutlp/vol12/iss3/5:http://ro.uow.edu.au/jutlp/vol12/iss3/5

Benson, J., & Clark, F. (1982). A guide for instrument development and validation. *American Journal of Occupational Therapy American Journal of Occupational Therapy, 36*(12), 789-800. https://doi.org/10.5014/ajot.36.12.789

Betz, E. N., Hommond, S. M., Multon, D. K. (2005). Reliability and validity of five-level response continua for the career decision self-efficacy scale. *Journal of Career Assessment, 13*(2), 131–150. http://doi.org/10.1177/1069072704273123

Bichi, A. A., Hafiz, H., & Bello, S. A. (2016). Evaluation of Northwest University, Kano Post-UTME test items using item response theory. *International Journal of Evaluation and Research in Education (IJERE)*, *5*(4), 261. https://doi.org/10.11591/ijere.v5i4.5953

Blau, P. M., Gustad, J. W., Jessor, R., Parnes, H. S., Wilcock, C., Review, S. I. L. R., Jul, N., Parnes, H. S., & Wilcock, R. C. (1956). Occupational choice: A conceptual framework. *Industrial & Labor Relations* Review, *9*(4), 531–543. http://doi.org/10.2307/2519672

Boyaci, D. B., & Atalay, N. (2016). A scale development for 21st Century skills of primary school students: A validity and reliability study. International Journal of Instruction, *9*(1), 133–135. https://doi.org/10.12973/iji.2016.9111a

Boyington, S. C. (2018). Inspiring the next generation of the STEM workforce. *Techniques, 93*(3), 22-27. http://proxy.lib.odu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=128260808&scope=site

Browne, M. W., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological Methods & Research*, *21*(2), 230–258. https://doi.org/10.1177/0049124192021002005

Brumwell, S., Deller, F., & Macfarlane, A. (2017). Why measurement matters: The learning outcomes approach-A case study from Canada. *Journal of Higher Education in Africa, 15*(1), 5–22. https://doi.org/10.2307/90016697

Burnham, K., & Anderson, D. (2003). *Model selection and multimodel inference: A practical-theoretic approach*. New York, NY: Springer- Verlag.

Burns, E. C., Martin, A. J., & Collie, R. J. (2021). A future time perspective of secondary school students' academic engagement and disengagement: A longitudinal investigation. *Journal of School Psychology*, *84*, 109–123. https://doi.org/10.1016/j.jsp.2020.12.003

Carl D. Perkins Career and Technical Education Improvement Act of 2006, 20 U.S.C. § 2301 et seq. (2006). https://www.congress.gov/109/plaws/publ270/PLAW-109publ270.pdf

Castellano, M., Sundell, K. E., Overman, L. T., & Aliaga, O. A. (2011). Rigorous tests of student outcomes in CTE programs of study: Year 3 report. http://www.nrccte.org/resources/publications/rigorous-tests-student-outcomes-cte-programs-study-year-3-report

Cattell, R. B. (1966). The Scree test for the number of factors. *Multivariate Behavioral Research*, *1*(2), 245-276. https://doi.org/10.1207/s15327906mbr0102_10

De Champlain, A. F. (2010). A primer on classical test theory and item response theory for assessments in medical education. *Medical education*, *44*(1), 109-117. https://doi.org/10.1111/j.1365-2923.2009.03425.x

Chen, W. H., & Thissen, D. (1997). Local dependence indexes for item pairs using item response theory. *Journal of Educational and Behavioral Statistics*, *22*(3), 265-289. https://doi.org/10.3102/10769986022003265

Childress, J., Backman, A. C., & Lipson, M. Y. (2020). Reframing literacy assessment: Using scales and micro-progressions to provide equitable assessments for all learners. *Journal of Adolescent & Adult Literacy, 63*(4), 371–377. https://doi-org.proxy.lib.odu.edu/10.1002/jaal.1016

Choi, Y., Kim, J., & Kim, S. (2015). Career development and school success in adolescents: The role of career interventions. *Career Development Quarterly*, *63*(2), 171–186. https://doi.org/10.1002/cdq.12012

Claro, M., Cabello, T., San Martín, E., & Nussbaum, M. (2015). Comparing marginal effects of Chilean students' economic, social and cultural status on digital versus reading and mathematics performance. *Computers & Education*, *82*, 1-10. https://doi.org/10.1016/j.compedu.2014.10.018

College and Career Readiness; Career Exposure, Exploration, and Planning; and Opportunities for Postsecondary Credit, Va Stat. §§ 8VAC20-131-140 (1997/2019). https://law.lis.virginia.gov/admincode/title8/agency20/chapter131/section140/

Colón, Y., & Sánchez, B. (2010). Explaining the gender disparity in Latino youth's education: Acculturation and economic value of education. *Urban Education, 45*(3), 252–273. https://doi.org/10.1177/0042085908322688

Cook, K. C. (2002). Layered literacies: A theoretical frame for technical communication pedagogy. *Technical Communications Quarterly, 21*(1), 5–29. https://doi.org/10.1207/s15427625tcq1101_1

Costello, A. B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Research, and Evaluation Practical Assessment, Research, and Evaluation, 10*(7), 1-9. https://doi.org/10.7275/jyj1-4868

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Holt, Rinehart and Winston.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334. https://doi.org/10.1007/BF02310555

Cudeck, R., & Henly, S. J. (1991). Model selection in covariance structures analysis and the "problem" of sample size: A clarification. *Psychological Bulletin*, *109*(3), 512–519. https://doi.org/10.1037/0033-2909.109.3.512

Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: The indirect role of parental expectations and the home environment. *Journal of Family Psychology, 19*(2), 294–304. https://doi.org/10.1037/0893-3200.19.2.294

Denscombe, M. (2009). Item non-response rates: a comparison of online and paper questionnaires. *International Journal of Social Research Methodology*, *12*(4), 281-291. https://doi.org/10.1080/13645570802054706

DeVellis, R. F. (2017). *Scale development: Theory and applications* (4th ed.). Sage publications.

Diemer, M. A., Marchand, A. D., & Mistry, R. S. (2020). Charting how wealth shapes educational pathways from childhood to early adulthood: A developmental process model. *Journal of Youth and Adolescence*, *49*(5), 1073–1091. https://doi.org/10.1007/s10964-019-01162-4

Dixit, B., Bedekar, M., Jahagirdar, A., & Sathe, N. (2021). Role of active learning techniques in development of problem-solving skills. *Journal of Engineering Education Transformations, 34*, 670-674. doi:10.16920/jeet/2021/v34i0/157241

Doustmohammadian, A., Omidvar, N., Keshavarz-Mohammadi, N., Abdollahi, M., Amini, M., & Eini-Zinab, H. (2017). Developing and validating a scale to measure Food and Nutrition Literacy (FNLIT) in elementary school children in Iran. *PLoS ONE, 12*(6), 1–18. https://doi.org/10.1371/journal.pone.0179196

Dubow, E. F., Boxer, P., & Huesmann, L. R. (2009). Long-term effects of parent's education on children's educational and occupational success. *Merrill-Palmer Quarterly, 55*(3), 224–249. https://www.jstor.org/stable/23096257

Eaton, M. (2020). *The perfect blend: A practical guide to designing student-centered learning experiences*. International Society for Technology in Education.

Ebesutani, C., Drescher, C. F., Reise, S. P., Heiden, L., Hight, T. L., Damon, J. D., & Young, J. (2012). The loneliness questionnaire-short version: An evaluation of reverse-worded and non-reverse-worded items via item response theory. *Journal of Personality Assessment*, *94*(4), 427–437. https://doi.org/10.1080/00223891.2012.662188

Edelen, M. O., & Reeve, B. B. (2007). Applying item response theory (IRT) modeling to questionnaire development, evaluation, and refinement. *Quality of life research*, *16*(1), 5-18. https://doi.org/10.1007/s11136-007-9198-0

Elder, S. (2015). What does NEETs mean and why is the concept so easily misinterpreted? International Labour Office. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_343153.pdf

Embretson, S. E., & Diehl, K. A. (2004). Item response theory. In *Encyclopedia of psychology, Vol. 4.* (pp. 378–380). American Psychological Association. https://doi.org/10.1037/10519-153

Embretson, S.E., & Reise, S.P. (2000). Item Response Theory (1st ed.). Psychology Press. https://doi.org/10.4324/9781410605269

ERIC. (2012). *Career readiness*. https://eric.ed.gov/?ti=Career+Readiness

Eshelman, A. J., & Rottinghaus, P. J. (2015). Viewing adolescents' career futures through the lenses of socioeconomic status and social class. *Career Development Quarterly*, *63*(4), 320–332. https://doi.org/10.1002/cdq.12031

Ezechukwu, R. I., Oguguo, B. C., E., Ene, C. U., & Ugorji, C. O. (2020). Psychometric Analysis of Economics Achievement Test Using Item Response Theory. *World Journal of Education*, *10*(2), 59. https://doi.org/10.5430/wje.v10n2p59

Farkas, G. (2004). The black-white test score gap. *Contexts, 3*(2), 12–19. https://doi.org/10.1525/ctx.2004.3.2.12

Finch, H. (2008). Estimation of item response theory parameters in the presence of missing data. *Journal of Educational Measurement, 45*(3), 225-245. https://doi.org/10.1111/j.1745-3984.2008.00062.x

Finney, S.J. & DiStefano, C. (2006). Non-normal and categorical data in structural equation modeling. In G. R. Hancock & R. O. Mueller (Hrsg.). *Structural Equation Modeling: A Second Course* (S. 269–314). Information Age Publishing.

Fisher, T. A., & Stafford, M. E. (1999). Reliability and validity of the career influence inventory: A pilot study. *Journal of Career Assessment, 7*(2), 187–202. https://doi.org/10.1177/106907279900700207

Fleming, J. (2000). Affirmative action and standardized test scores. *The Journal of Negro Education, 69*(1/2), 27-37. http://www.jstor.org/stable/2696262

Foldesy, E. M., & Foldesy, G. (1993). Occupational education: Equity issues. *The Clearing House*, *67*(2), 69–70. https://doi.org/10.1080/00098655.1993.9956022

Forte, J., Storey, K., & Gaylord-Ross, R. (1989). The Social Validation of Community Vocational Training in Technological Work Settings. *Education and Training in Mental Retardation*, *24*(2), 149–156. http://www.jstor.org/stable/23878470

Fouad, N. A., Smith, P. L., & Enochs, L. (1997). Reliability and validity evidence for the middle school self-efficacy scale. *Measurement and Evaluation in Counseling and Development*, *30*(1), 17-31. https://doi.org/10.1080/07481756.1997.12068914

Fries, J., Bruce, B., & Cella, D. (2005). The promise of PROMIS: Using item response theory to improve assessment of patient-reported outcomes. Clinical and Experiment Rheumatology, 23(5, Suppl. 39), S53–S57. https://pubmed.ncbi.nlm.nih.gov/16273785/

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of concept, state of evidence. *Review of Educational Research*, *74*, 59–109. https://doi.org/10.3102/00346543074001059

Gammarano, R. (2019). Labour market access- A persistent challenge for youth around the world. (5). International Labour Organization. https://ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_676196.pdf

Gati, I., & Saka, N. (2001). High school students' career-related decision making difficulties. *Journal of Counseling and Development, 79*(3), 331-340. https://doi.org/10.1002/j.1556-6676.2001.tb01978.x

Geist, M. R. (2010). Using the Delphi method to engage stakeholders: A comparison of two studies. *Evaluation and Program Planning, 33*(2), 147-154. https://doi.org/10.1016/j.evalprogplan.2009.06.006

Gelfand, A., & Dey, D. (1994). Bayesian model choice: Asymptotics and exact calculations. Journal of the Royal Statistical Society, Series B, 56, 501–514. https://www.jstor.org/stable/2346123

Gibbons, M. M., & Shoffner, M. F. (2004). Perspective first-generation college students: Meeting their needs through Social Cognitive Career Theory. *Professional School Counseling, 8*(1), 91–97. http://www.jstor.org/stable/42732419

Gnilka, P. B., & Novakovic, A. (2017). Gender differences in STEM students' perfectionism, career search self-efficacy, and perception of career barriers. *Journal of Counseling and Development, 95*(1), 56–66. https://doi.org/10.1002/jcad.12117

Godbey, S., & Gordon, H. R. (2019). Career exploration at the middle school level: Barriers and opportunities. *Middle Grades Review, 5*(2). https://scholarworks.uvm.edu/mgreview/vol5/iss2/2

Goleman, D. (1998). Working with emotional intelligence. Bloomsbury.

Gordon, H. (2014). *The History and Growth of Career and Technical Education in America*. Waveland.

Gottfredson, L. S. (1981). Circumscription and compromise: A developmental theory of occupational aspirations. *Journal of Counseling Psychology, 28*(6), 545–579. https://doi.org/10.1037/0022-0167.28.6.545

Green, D. R., Yen, W. M., & Burket, G. R. (1989). Experiences in the application of item response theory in test construction. *Applied Measurement in Education*, *2*(4), 297-312.

Guillon, V., Dosnon, O., Esteve, M. D., & Gosling, P. (2004). Self-efficacy and behavioral intention: A mediational analysis of the effects of commitment on career counseling.

European Journal of Psychology of Education, 19(3), 315–332. https://doi.org/10.1007/BF03173226

Hambleton, R. K., Robin, F., & Xing, D. (2000). Item response models for the analysis of educational and psychological test data. In Handbook of applied multivariate statistics and mathematical modeling (pp. 553-581). Academic Press.

Hambleton, R. K. and Hariharan, S. (1985). *Item Response Theory: Principles and Applications*. Kluwer-Nijhoff.

Heathington, B. (1987). Expanding the definition of literacy for adult remedial readers. *Journal of Reading*, *31*(3), 213–217. http://www.jstor.org/stable/40029846

Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational Research Methods, 1*(1), 104–121. https://doi.org/10.1177/109442819800100106

Hinkin, T. R., Tracey, J. B., & Enz, C. A. (1997). Scale construction: Developing reliable and valid measurement instruments. *Journal of Hospitality & Tourism Research, 21*(1), 100–120. https://doi.org/10.1177/109634809702100108

Ho, E. S. C., & Sum, K. W. (2018). Construction and validation of the Career and Educational Decision Self-Efficacy Inventory for secondary students (CEDSIS). *Journal of Psychoeducational Assessment*, *36*(2), 162-174. https://doi.org/10.1177/0734282916674135

Hoffman, L. W. (1977). Changes in family roles, socialization, and sex differences. *American Psychologist, 32*(8), 644–657. https://doi.org/10.1037/0003-066X.32.8.644

Holland, J. L. (1959). A theory of vocational choice. *Journal of Counseling Psychology*, *6*(1), 35.

Holland, M. M., & Deluca, S. (2016). '"Why wait years to become something?"' Low-income African American youth and the costly career search in for-profit trade schools. *Sociology of Education, 89*(4), 261–278. https://doi.org/10.1177/0038040716666607

Hoyle, R. H. (1995). *Structural equation modeling: Concepts, issues, and applications*. Sage.

Hsu, C. C., & Sandford, B. A. (2007). The Delphi technique: Making sense of consensus The Delphi technique: Making sense of consensus. *Practical Assessment, Research and Evaluation, 12*(10). https://doi.org/10.7275/pdz9-th90

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Huang, J. T., & Hsieh, H. H. (2011). Linking socioeconomic status to social cognitive career theory factors: A partial least squares path modeling analysis. *Journal of Career Assessment, 19*(4), 452–461. https://doi.org/10.1177/1069072711409723

Huang, P. H. (2017). Asymptotics of AIC, BIC, and RMSEA for Model Selection in Structural Equation Modeling. *Psychometrika*, *82*(2), 407–426. https://doi.org/10.1007/s11336-017-9572-y

Hughes, K. (2012). The college completion agenda progress report. (40). College Board Advocacy & Policy Center. http://completionagenda.collegeboard.org/sites/default/files/reports_pdf/Progress_Report_2010.pdf

Hung-Chang, L., & Mei-Ju, C. (2014). Behind the mask: The differences and stability of children's career expectations. *Procedia - Social and Behavioral Sciences, 116*(2002), 2832–2840. https://doi.org/10.1016/j.sbspro.2014.01.665

Immekus, J. C., Snyder, K. E., & Ralston, P. A. (2019). Multidimensional Item Response Theory for Factor Structure Assessment in Educational Psychology Research. *Frontiers in Education*, *45*(4*)*. https://doi.org/10.3389/feduc.2019.00045

Ireh, M. (2000). Career development theories and their implications for high school career guidance and counseling. *The High School Journal, 83*(2), 28–40. http://www.jstor.org/stable/40364508

James, K. P. (2016). Single-subject research method: The needed simplification. *British Journal of Education*, *4*(6), 68-95.

Jarrett, R. L., & Coba-Rodriguez, S. (2017). "We keep the education goin' at home all the time": Family literacy in low-income African American families of preschoolers. *Journal of Education for Students Placed at Risk*, *22*(2), 57–76. https://doi.org/10.1080/10824669.2017.1295861

Johanson, G. A., & Brooks, G. P. (2010). Initial scale development: Sample size for pilot studies. *Educational and Psychological Measurement, 70*(3), 394-400. https://doi.org/10.1177/0013164409355692

Kim, K. H., & Zabelina, D. (2015). Cultural bias in assessment: Can creativity assessment help?. *The International Journal of Critical Pedagogy*, *6*(2). http://libjournal.uncg.edu/ijcp/article/view/301/856

Kitson, H., & Lingenfelter, M. R. (1936). *Vocational guidance through the library: A guide, showing how the librarian can serve individuals who are trying to solve vocational problems* (3rd ed.). American Library Association.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York, NY: Guilford Press.

Knoll, M. A. Z., & Houts, C. R. (2012). The Financial Knowledge Scale: An Application of Item Response Theory to the Assessment of Financial Literacy. *Journal of Consumer Affairs*, *46*(3), 381–410. https://doi.org/10.1111/j.1745-6606.2012.01241.x

Kuijpers, M., Meijers, F., & Gundy, C. (2011). The relationship between learning environment and career competencies of students in vocational education. *Journal of Vocational Behavior, 78*(1), 21–30. https://doi.org/10.1016/j.jvb.2010.05.005

Kulcsár, V., Dobrean, A., & Gati, I. (2020). Challenges and difficulties in career decision making: Their causes, and their effects on the process and the decision. *Journal of Vocational Behavior, 116*, 103346. https://doi.org/10.1016/j.jvb.2019.103346

Kumasi, K. D. (2011). The impact of libraries on young adults: Toward a critical research agenda. *The Journal of Research on Libraries and Young Adults (2)*1. http://www.yalsa.ala.org/jrlya/2011/11/the-impact-of-libraries-on-young-adults-toward-a-critical-research-agenda/

Lapan, R. T., Poynton, T., Marcotte, A., Marland, J., & Milam, C. M. (2017). College and Career Readiness Counseling Support Scales. *Journal of Counseling & Development, 95*(1), 77-86. http://doi.org/10.1002/jcad.12119

Larsen, K. (2007). Health Literacy. In P. Walker & E. Barnett (Eds.), *Immigrant Medicine* (pp.711-724). Elsevier. https://doi.org/10.1016/B978-0-323-03454-8.50061-9

Lau, W. W. F., & Yuen, A. H. K. (2014). Developing and validating of a perceived ICT literacy scale for junior secondary school students: Pedagogical and educational contributions. *Computers and Education*, *78*, 1–9. https://doi.org/10.1016/j.compedu.2014.04.016

Lent, R. W., & Brown, S. D. (2006). On conceptualizing and assessing social cognitive constructs in career research: A measurement guide. *Journal of Career Assessment*, *14*(1), 12-35. https://doi.org/10.1177/1069072705281364

Lent, R. W., Brown, S. D., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive analysis. *Journal of Counseling Psychology, 47*(1), 36–49. https://doi.org/10.1037/0022-0167.47.1.36

Lent, R., Brown, S. D., & Hackett, G. (1994). Toward a unifying SCCT and academic interest, choice and performance. *Journal of Vocational Behavior*, *45*(1), 79–122. https://doi.org/10.1006/jvbe.1994.1027

Lent, R. W., Ireland, G. W., Penn, L. T., Morris, T. R., & Sappington, R. (2017). Sources of self-efficacy and outcome expectations for career exploration and decision making: A test of the social cognitive model of career self-management. *Journal of Vocational Behavior*, *99*, 107–117. https://doi.org/10.1016/j.jvb.2017.01.002

Liu, Y., Mao, Y., & Wong, C. S. (2020). Theorizing parental intervention and young adults' career development: A social influence perspective. *Career Development International*, *25*(4), 415–428. https://doi.org/10.1108/CDI-01-2019-0028

Lord, F. M. (1980). *Applications of item response theory to practical testing problems*. Hillsdale NJ: Erlbaum.

Lord, F. M. (1968). An analysis of the verbal scholastic aptitude test using Birnbaum's three-parameter logistic model. *Educational and Psychological Measurement*, *28*(4), 989-1020. https://doi.org/10.1177/001316446802800401

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods*, *4*(1), 84–99. https://doi-org.proxy.lib.odu.edu/10.1037/1082-989X.4.1.84

Makransky, G., Rogers, M. E., & Creed, P. A. (2015). Analysis of the construct validity and measurement invariance of the career decision self-efficacy scale: A Rasch model approach. *Journal of Career Assessment*, *23*(4), 645-660. https://doi-org.proxy.lib.odu.edu/10.1177/1069072714553555

Malin, J. R., Bragg, D. D., & Hackmann, D. G. (2017). College and Career Readiness and the Every Student Succeeds Act. *Educational Administration Quarterly*, *53*(5), 809–838. https://doi.org/10.1177/0013161X17714845

Mann, A., Denis, V. & Percy, C. (2020), "Career ready?: How schools can better prepare young people for working life in the era of COVID-19", *OECD Education Working Papers*, No. 241, OECD Publishing, Paris, https://doi.org/10.1787/e1503534-en.

Marcionetti, J., & Rossier, J. (2017). The mediating impact of parental support on the relationship between personality and career indecision in adolescents. *Journal of Career Assessment, 25*(4), 601–615. https://doi.org/10.1177/1069072716652890

Marianti, S., Permatasari, D. P., & Rahajeng, U. W. (2021). Applying item response theory model for evaluating item and test properties of academic potential test for students with disability. *Jurnal Penelitian dan Evaluasi Pendidikan*, *25*(1). https://doi.org/10.21831/pep.v25i1.38808

Marrelli, A. F. (1995). Writing Multiple-Choice Test Items. *Performance and Instruction*, *34*(8), 24-29. https://doi.org/10.1002/pfi.4170340807

Massachusetts Institute for College and Career Readiness. (2018). College and career readiness resources. http://sites.bu.edu/miccr/

Matsunaga, M., (2010). How to factor-analyze your data right: Do's, dont's, and how-to's. *International Journal of Psychological Research, 3* (1), 97-110. http://doi.org/10.21500/20112084.854

Maydeu-Olivares, A. (2013). Goodness-of-fit assessment of item response theory models. *Measurement*, *11*(3), 71–101. https://doi.org/10.1080/15366367.2013.831680

McFadden, A., & Curry, J. R. (2018). State leaders' and school counselors' roles in elementary and middle school career development: Research findings and promising practices. *Techniques: Connecting Education & Careers, 93*(3), 46–49. http://search.ebscohost.com/login.aspx?direct=true&db=eue&AN=128260812&lang=es&site=ehost-live

McKenna, M. C., Conradi, K., Lawrence, C., Jang, B. G., & Meyer, J. P. (2012). Reading attitudes of middle school students: Results of a U.S. survey. *Reading Research Quarterly, 47*(3), 283–306. https://doi.org/10.1002/RRQ.021

Mckinley, R. L., & Mills, C. N. (1985). A comparison of several goodness-of-fit statistics. *Applied Psychological Measurement*, *9*(1), 49–57. https://doi.org/10.1177/014662168500900105

Mishkind, A. (2014). Overview: State definitions of college and career readiness. American Institute for Research. https://ccrscenter.org/sites/default/files/CCRS%20Defintions%20Brief_REV_1.pdf

Mishra, S., Sharma, M., Sharma, R. C., Singh, A., & Thakur, A. (2016). Development of a scale to measure faculty attitude towards open educational resources. *Open Praxis, 8*(1), 55–69. https://doi.org/10.5944/openpraxis.8.1.236

Mundfrom, D. J., Shaw, D. G., & Ke, T. L. (2005). Minimum sample size recommendations for conducting factor analyses. *International Journal of Testing, 5*(2), 159–168. https://doi.org/10.1207/s15327574ijt0502_4

Naigaga, D. A., Pettersen, K. S., Henjum, S., & Guttersrud, Ø. (2018). Assessing adolescents' perceived proficiency in critically evaluating nutrition information. *International Journal of Behavioral Nutrition and Physical Activity*, *15*(1), 61. https://doi.org/10.1186/s12966-018-0690-4

National Center for Education Statistics. (2019). Indicator 23: Postsecondary Graduation Rates (updated February 2019). https://nces.ed.gov/programs/raceindicators/indicator_RED.asp

National Council of Teachers of English Working Group. (2018). *Literacy assessment: Definitions, principles, and practices*. https://ncte.org/statement/assessmentframingst/

National Council of Teachers of English Working Group. (2020). *Expanding formative assessment for equity and agency*. https://ncte.org/statement/expanding-formative-assessment/

Nauta, M. M. (2010). The development, evolution, and status of Holland's theory of vocational personalities: Reflections and future directions for counseling psychology. *Journal of Counseling Psychology, 57*(1), 11–22. https://doi.org/10.1037/a0018213

Naviance | Hobsons. (n.d.). https://www.hobsons.com/solution/naviance/#overview

Netemeyer, R. G., Bearden, W. O., & Sharma, S. (2003). *Scaling procedures: Issues and applications*. Sage Publications.

Nunnally, J. O. (1978). *Psychometric theory*. McGraw-Hill.

Nutbeam, D. (1998) Health promotion glossary. Health Promotion International, *13*(4). https://academic.oup.com/heapro/article-pdf/13/4/349/6750429/13-4-349.pdf

O'Higgins, N. (2017). Rising to the youth employment challenge: New evidence on key policy issues. International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_556949.pdf

OECD. (2019). Education at a Glance 2019. In Education at a Glance: OECD Indicators. OECD. https://doi.org/10.1787/f8d7880d-en

Oh, Y. J., Jia, Y., Lorentson, M., & LaBanca, F. (2013). Development of the educational and career interest scale in science, technology, and mathematics for high school students. *Journal of Science Education and Technology, 22*(5), 780–790. https://doi.org/10.1007/s10956-012-9430-8

Okoli, C., & Pawlowski, S. D. (2004). The Delphi method as a research tool: An example, design considerations and applications. *Information and Management, 42*(1), 15–29. https://doi.org/10.1016/j.im.2003.11.002

Olle, C. D., & Fouad, N. A. (2015). Parental support, critical consciousness, and agency in career decision making for urban students. *Journal of Career Assessment, 23*(4), 533–544. https://doi.org/10.1177/1069072714553074

Orlando, M., & Marshall, G. N. (2002). Differential item functioning in a Spanish translation of the PTSD checklist: detection and evaluation of impact. *Psychological Assessment*, *14*(1), 50. https://doi/10.1037/1040-3590.14.1.50

Orlando, M., & Thissen, D. (2000). Likelihood-based item-fit indices for dichotomous item response theory models. *Applied Psychological Measurement*, *24*(1), 50–64. https://doi.org/10.1177/01466216000241003

Osipow, S. H. (1990). Convergence in theories of career choice and development: Review and prospect. *Journal of Vocational Behavior, 36*(2), 122–131. https://doi.org/10.1016/0001-8791(90)90020-3

Paek, I., & Cole, K. (2019). *Using R for item response theory model applications*. Routledge.

Passmore, D., & Mohamed, D. (1995). Labor Force Literacy and the Economy. *The Journal of Technology Studies, 21*(2), 8-14. http://www.jstor.org/stable/43603772

Patten, M. (2011). *Questionnaire research a practical guide* (3rd ed.). Pyrczak Pub.

Patten, M. (2016). *Questionnaire research: A practical guide*. Routledge.

Pett, M. A., Lackey, N. R., & Sullivan, J. J. (2003). Making sense of factor analysis: The use of factor analysis for instrument development in health care research. Sage Publications.

Plank, S. B., & Jordan, W. J. (2001). Effects of information, guidance, and actions on postsecondary destinations: A study of talent loss. *American Educational Research Journal*, *38*(4), 947–979. https://doi.org/10.3102/00028312038004947

Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Research in Nursing and Health*, *29*(5), 489–497. https://doi.org/10.1002/nur.20147

Powell, W. R. (1977). Levels of literacy. *Journal of Reading*, *20*(6), 488-492. http://www.jstor.org/stable/40010898

Program of Instruction and Learning Objectives, Va. Stat. §§ 8VAC20-131-70

(1997 & rev. 2018). https://law.lis.virginia.gov/admincode/title8/agency20/chapter131/section70/

Rao, C., Kishan Prasad, H., Sajitha, K., Permi, H., & Shetty, J. (2016). Item analysis of multiple-choice questions: Assessing an assessment tool in medical students. *International Journal of Educational and Psychological Researches*, *2*(4), 201. https://doi.org/10.4103/2395-2296.189670

Raykov, T., & Marcoulides, G. A. (2018). *A course in item response theory and modeling with Stata*. College Station, TX: Stata Press.

Reeve, B.B., & Fayers, P. (2005). Applying item response theory modeling for evaluating questionnaire items and scale properties. In: Fayers P, Hays R, eds., *Assessing Quality of Life in Clinical Trials: Methods and Practice* (2nd ed.). Oxford: Oxford University Press.

Requirements for Graduation (Effective with the students who enter the ninth grade prior to the 2018–2019 school year), Va. Stat. §§ 8VAC20-131-50 (1997 & rev. 2018). https://law.lis.virginia.gov/admincode/title8/agency20/chapter131/section50/

Requirements for Graduation (Effective with the students who enter the ninth grade in the 2018–2019 school year), Va. Stat. §§ 8VAC20-131-51 (2018 & rev. 2019). https://law.lis.virginia.gov/admincode/title8/agency20/chapter131/section51/

Rodríguez-de-Dios, I., van Oosten, J. M. F., & Igartua, J. J. (2018). A study of the relationship between parental mediation and adolescents' digital skills, online risks and online opportunities. *Computers in Human Behavior, 82*, 186–198. https://doi.org/10.1016/j.chb.2018.01.012

Roe, A. (1957). Early determinants of vocational choice. *Journal of Counseling Psychology, 4*(3), 212–217. https://doi.org/10.1037/h0045950

Rojewski, J., & Xing, X. (2013). Treatment of race/ethnicity in career-technical education research. *Career and Technical Education Research*, *38*(3), 245-256. http://doi.org/10.5328/CTER38.3.245

Şahin, A., & Anıl, D. (2017). The Effects of Test Length and Sample Size on Item Parameters in Item Response Theory. *Educational Sciences: Theory & Practice*, *17*(1). https://doi.org/10.12738/estp.2017.1.0270

Savickas, M. L. (1990, March). Developing career choice readiness. Paper presented at the annual meeting of the American Association for Counseling and Development. Cincinnati, OH

Savickas, M. L. (1994). Measuring career development: Current status and future directions. *Career Development Quarterly*, *43*(1), 54. https://doi-org.proxy.lib.odu.edu/10.1002/j.2161- 0045.1994.tb00846.x

Schinka, J. A., & Borum, R. (1993). Readability of adult psychopathology inventories. *Psychological Assessment, 5*(3), 384–386. https://doi.org/10.1037/1040-3590.5.3.384

Schoon, I. (2001). Teenage job aspirations and career attainment in adulthood: A 17-year follow-up study of teenagers who aspired to become scientists, health professionals, or engineers. *International Journal of Behavioral Development, 25*(2), 124–132. https://doi.org/10.1080/01650250042000186

Schumacker, R. E., & Lomax, R. G. (2010). *A beginner's guide to structural equation modeling* (3rd ed.). Routledge Academic.

Schwarz, G. (1978). Estimating the dimension of a model. Annals of Statistics, *6*, 461–464. http://doi:10.1214/aos/1176344136

Shanahan, T., & Shanahan, C. (2012). What is disciplinary literacy and why does it matter? *Topics in Language Disorders, 32*(1), 7–18. https://doi.org/10.1097/TLD.0b013e318244557a

Sinharay, S., & Haberman, S. J. (2014). How often is the misfit of item response theory models practically significant? *Educational Measurement: Issues and Practice, 33*(1), 23–35. https://doi.org/10.1111/emip.12024

Sireci, S. G. (1991, June). Sample independent item parameters? An investigation of the stability of IRT item parameters estimated from small data sets. Paper presented at the annual Conference of Northeastern Educational Research Association, New York, NY.

Social Security Administration. (2015, November). *Education and lifetime earnings*. https://www.ssa.gov/policy/docs/research-summaries/education-earnings.html

Stover, A. M., McLeod, L. D., Langer, M. M., Chen, W. H., & Reeve, B. B. (2019). State of the psychometric methods: patient-reported outcome measure development and refinement using item response theory. *Journal of Patient-Reported Outcomes*, *3*(1). https://doi.org/10.1186/s41687-019-0130-5

Strengthening Career and Technical Education for the 21st Century Act, P. L. 115 – 24 § 132 Stat (2018). https://uscode.house.gov/statutes/pl/115/224.pdf

Sullivan, G. M. (2011). A primer on the validity of assessment instruments. *Journal of Graduate Medical Education, 3*(2), 119–120. https://doi.org/10.4300/jgme-d-11-00075.1

Super, D. E. (1953). A theory of vocational development. *American Psychologist, 8*(5), 185–190. https://doi.org/10.1037/h0056046

Suruchi, S., & Rana, S. S. (2012). Test item analysis and relationship between difficulty level and discrimination index of test items in an achievement test in Biology. *Paripex - Indian Journal of Research*, *3*(6), 56–58. https://doi.org/10.15373/22501991/june2014/18

Symonds, W. C., Schwartz, R., & Ferguson, R. F. (2011). *Pathways to prosperity: Meeting the challenge of preparing young Americans for the 21st century*. Harvard University Graduate School of Education. http://www.gse.harvard.edu/news_events/features/2011/Pathways_to_Prosperity_Feb2011.pdf

Tang, M., Pan, W., & Newmeyer, M. (2008). Factors influencing high school students' career aspirations. *Professional School Counseling, 11*(5), 285–295. https://doi.org/10.5330/psc.n.2010-11.285

Taylor, K. M., & Betz, N. E. (1983). Applications of self-efficacy theory to the understanding and treatment of career indecision. *Journal of Vocational Behavior, 22*(1), 63–81. https://doi.org/10.1016/0001-8791(83)90006-4

Teo, T. (2013). Handbook of quantitative methods for educational research. Handbook of Quantitative Methods for Educational Research. Sense Publishers. https://doi.org/10.1007/978-94-6209-404-8

The Pell Institute for the Study of Opportunity in Higher Education. (2018). *Indicators of higher education equity in the United States: 2018 Historical trend report*. http://pellinstitute.org/downloads/publications-Indicators_of_Higher_Education_Equity_in_the_US_2018_Historical_Trend_Report.pdf

Tinsley, H. E. A., & Tinsley, D. J. (1987). Uses of factor analysis in counseling psychology research. *Journal of Counseling Psychology, 34*(4), 414–424. https://doi.org/10.1037/0022-0167.34.4.414

Tracey, T. J. G. (2001). The development of structure of interests in children: Setting the stage. *Journal of Vocational Behavior, 59*(1), 89–104. https://doi.org/10.1006/jvbe.2000.1787

Trice, A. (1991). A retrospective study of career development: Relationship among first aspirations, parental occupations, and current occupations. *Psychological Reports, 68*(1), 287–290. https://doi.org/10.2466/pr0.1991.68.1.287

Turner, S. L., Joeng, J. R., Sims, M. D., Dade, S. N., & Reid, M. F. (2019). SES, gender, and STEM career interests, goals, and actions: A test of SCCT. *Journal of Career Assessment, 27*(1), 134–150. https://doi.org/10.1177/1069072717748665

United Nations. (2020). Promote inclusive and sustainable economic growth, employment, and decent work for all. Sustainable development goals. https://www.un.org/sustainabledevelopment/wp-content/uploads/2016/08/8_Why-It-Matters-2020.pdf

U.S. Department of Health and Human Services. (2019). *The changing face of America's adolescents*. Retrieved from https://www.hhs.gov/ash/oah/facts-and-stats/changing-face-of-americas-adolescents/index.html.

Valentine, K.S. & Kosloski, M. F. (2021). Developing the key constructs of career literacy: A Delphi study. *Journal of Research in Technical Careers*, *5*(1). https://doi.org/10.9741/2578-2118.1095

van der Linden, W. J., & Hambleton, R. K. (Eds.). (1996). *Handbook of Modern Item Response Theory*. Springer Science & Business Media.

Vidgen, H. A., & Gallegos, D. (2014). Defining food literacy and its components. *Appetite, 76*, 50–59. https://doi.org/10.1016/j.appet.2014.01.010

Virginia Department of Education. (n.d.) Academic & career plan. http://www.doe.virginia.gov/instruction/graduation/academic_career_plan/index.shtml

Viswanathan, M. (2005). *Measurement error and research design*. Sage.

Voorhees, S., Bausch, L., & Inserra, A. (2007). Validation of the literacy representations survey: A tool for assessing reading and writing affect. *Journal of Reading Education*, *32*(3), 28–36. http://proxy.lib.odu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=26019273&scope=site

Warm, T. A. (1978). *A Primer of Item Response Theory*. Coast Guard Washington DC. https://apps.dtic.mil/sti/citations/ADA063072

Watson, M., & McMahon, M. (2005). Children's career development: A research review from a learning perspective. *Journal of Vocational Behavior, 67*(2), 119–132. https://doi.org/10.1016/j.jvb.2004.08.011

Wei, H., Cromwell, A. M., & McClarty, K. L. (2016). Career readiness: An analysis of text complexity for occupational reading materials. *Journal of Educational Research*, *109*(3), 266–274. https://doi.org/10.1080/00220671.2014.945149

Weider, R. I. (2019, November 22). Evaluating what makes a U.S. community urban, suburban or rural. *Decoded, Pew Research Center*. https://medium.com/pew-research-center-decoded/evaluating-what-makes-a-u-s-community-urban-suburban-or-rural-159f9d082842

Weinger, S. (1998). Children living in poverty: Their perception of career opportunities. *Families in Society: The Journal of Contemporary Human Services, 79*, 320–330. https://doi.org/10.1606/1044-3894.993

Westland, J. C. (2010). Lower bounds on sample size in structural equation modeling. *Electronic Commerce Research and Applications*, *9*(6), 476–487. https://doi.org/10.1016/j.elerap.2010.07.003

Widaman, K. F. (1985). Hierarchically nested covariance structure models for multitrait-multimethod data. *Applied Psychological Measurement*, *9*(1), 1-26. https://doi.org/10.1177/014662168500900101

Wiggan, G. (2007). Race, school achievement, and educational inequality: Toward a student-based inquiry perspective. *Review of Educational Research, 77*(3), 310–333. https://doi.org/10.3102/003465430303947

Worthington, R. L., & Whittaker, T. A. (2006). Scale development research: A content analysis and recommendations for best practices. *The Counseling Psychologist*, *34*(6), 806-838. http://doi.org/10.1177/0011000006288127

Wright, B. & Stone, M. (1979). *Best test design*. MESA Press: Chicago, IL

Yang, Y. (2005). Can the strengths of AIC and BIC be shared? A conflict between model identification and regression estimation. *Biometrika*, *92*(4), 937–950. https://www.jstor.org/stable/20441246

Young Adult Library Services Association. (2018, October 17). Mission, Vision, and Impact Statements. http://www.ala.org/yalsa/aboutyalsa/mission%26vision/yalsamission

Yuen, M., Gysbers, N. C., Chan, R. M., Lau, P. S., Leung, T. K., Hui, E. K., & Shea, P. M. (2005). Developing a career development self-efficacy instrument for Chinese

adolescents in Hong Kong. *International Journal for Educational and Vocational Guidance*, 5(1), 57-73. https://doi.org/10.1007/s10775-005-2126-3

APPENDIX A HUMAN SUBJECTS APPROVAL LETTER (ODU)

OFFICE OF THE VICE PRESIDENT FOR RESEARCH

Physical Address
4111 Monarch Way, Suite 203
Norfolk, Virginia 23508
Mailing Address
Office of Research
1 Old Dominion University
Norfolk, Virginia 23529
Phone(757) 683-3460
Fax(757) 683-5902

DATE:	September 29, 2021
TO:	Michael Kosloski, PhD
FROM:	Old Dominion University Institutional Review Board
PROJECT TITLE:	[1761605-2] Career literacy: Developing, validating, and establishing the reliability of the Career Literacy Continuum Scale
REFERENCE #:	21-076
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	September 29, 2021
NEXT REPORT DUE:	September 28, 2022
REVIEW TYPE:	Expedited Review

Thank you for your submission of New Project materials for this project. The Old Dominion University Institutional Review Board has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulations.

This project has been determined to be a MINIMAL RISK project. Based on the risks, this project does not require continuing review. You will receive an annual check in reminder. Please complete the annual check in form and submit it for administrative approval by your next report due date of September 28, 2022.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

APPENDIX B INFORMED CONSENT

INFORMED CONSENT DOCUMENT

OLD DOMINION UNIVERSITY

Online via

PROJECT TITLE: Career literacy: Developing, validating, and establishing the reliability of the Career Literacy Continuum Scale

INTRODUCTION

The purposes of this form are to give you information that may affect your decision whether to say YES or NO to participation in this research, and to record the consent of those who say YES.

RESEARCHERS

Mickey Kosloski, Ph.D., Old Dominion University, College of Education, Principal Investigator
Kesha Valentine, Doctoral Candidate, Old Dominion University

DESCRIPTION OF RESEARCH STUDY

We are asking permission for your child to take part in a study to create a test that measures their ability to understand, interpret, evaluate, and make decisions with career-related information. Because students have to make so many decisions that may have long-lasting effects, it is important to analyze the students' capacity to make the appropriate decisions regarding their career preparation in a secondary school setting.

The purpose of this research is to create a test that accurately determines the career literacy skills and knowledge adolescents currently possess. For the purposes of this study, I am defining career literacy as the functional, interactive, and critical skills needed to understand, interpret, evaluate, and make decisions with career-related information.

If you allow your child to participate, they will be asked to complete a digital survey that asks them questions using career-related scenarios. No preparation is necessary. If you say YES, they will receive a link to the digital survey form at an email address that you provide. They will be given the option to indicate their willingness to participate in the study when they open the link. Their participation will consist of reading questions and selecting the most appropriate response to those questions. Communication about the survey will come from school staff and the researcher will not have any direct contact with your child.

Approximately 500 students will take part in this study.

EXCLUSIONARY CRITERIA

Any student in grades 6 – 12, or aged 11 – 19 is eligible to participate. The student will need to be able to operate a computer and mouse to make the appropriate selections.

RISKS AND BENEFITS

RISKS: This study should pose no more than minimal risk to your student. Your student may experience discomfort from awareness of unfamiliar career concepts. Your student can choose not to answer any questions for any reason and can stop the survey at any time.

If you would like, you can look at the questions your student will be asked before agreeing to be in the study.

BENEFITS: Learning about the students' capacity in each of the areas of career literacy and potentially design improved curricular experiences.

COSTS AND PAYMENTS

The researchers want your decision about participating in this study to be absolutely voluntary. There is no compensation provided for your participation.

NEW INFORMATION

If the researchers find new information during this study that would reasonably change your decision about participating, then they will give it to you.

CONFIDENTIALITY

The researchers will take reasonable steps to keep private information, such as your responses and your agreement to allow your child to participate, confidential. The researchers will remove all identifiers from the information. The results of this study may be used in reports, presentations, and publications; but the researcher will not identify your child or the name and exact location of the school or school district. Of course, your records may be subpoenaed by court order or inspected by government bodies with oversight authority.

WITHDRAWAL PRIVILEGE

It is OK for you to say NO. Even if you say YES now, you are free to say NO later, and walk away or withdraw from the study -- at any time. Your decision will not affect your relationship with Old Dominion University, or otherwise cause a loss of benefits to which you might otherwise be entitled.

COMPENSATION FOR ILLNESS AND INJURY

If you say YES, then your consent in this document does not waive any of your legal rights. However, in the event of harm arising from this study, neither Old Dominion University nor the researchers are able to give you any money, insurance coverage, free medical care, or any other compensation for such injury. In the event that you suffer injury as a result of participation in any research project, you may contact the Principal Investigator, Mickey Kosloski or Kesha Valentine, Dr. Tancy Vandecar-Burdin, the current IRB chair, at Old Dominion University, or the Old Dominion University Office of Research at who will be glad to review the matter with you.

VOLUNTARY CONSENT

By signing this form, you are saying several things. You are saying that you have read this form or have had it read to you, that you are satisfied that you understand this form, the research study, and its risks and benefits. The researchers should have answered any questions you may

have had about the research. If you have any questions later on, then the researchers should be able to answer them:

Mickey Kosloski, Principal Investigator,
Kesha Valentine

If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should call Dr. Tancy Vandecar-Burdin, the current IRB chair, at, or the Old Dominion University Office of Research, at.

And importantly, by signing below, (or clicking, if using a digital consent) you are telling the researcher YES, you are providing permission for your student to participate in this study. The researcher should give you a copy of this form for your records.

APPENDIX C ITEM DETAILS

Item ID	Career Literacy Skill/Concept	*N*
AKEXPL	Knowledge of career options and job outlooks and how Career Clusters and Pathways are connected to career exploration	254
AKMATH	Manipulate basic math functions, exemplifying data literacy	216
AKSTEP1	Identify the steps needed to gain the required skills toward entry into a career	257
AKSTEP2	Identify the steps needed to gain the required skills toward entry into a career	256
CTARQ1	Ask the "right" questions to seek answers, provide clarity, or to problem-solve	258
CTARQ2	Ask the "right" questions to seek answers, provide clarity, or to problem-solve	186
CTCONS	Calculate the consequences of irrational long-term and career-limiting decisions	187
CTCRED	Analyze the credibility of a source of information	260
CTDEC1	Conduct career research to inform career decisions	257
CTDEC2	Analyze an environment to address barriers to career entry	191
CTFACT	Adjudicate facts versus opinions	186
CTINTR1	Interpret professional etiquette expectations (communication, attire, topics, etc.), as well as how those expectations may vary from one career to another	254
CTINTR2	Interpret information from datasets, or others graphical representations of data	239
CTLADS	Translate career progressions and different steps within a career ladder	260
CTMTCH	Match ones' own values, interests, and skills, with a compatible career	190
CTREAD	Read, process, and interpret career information regarding employment	192
CTREAL	Apply what has been read to real-world situations	199

Item ID	Career Literacy Skill/Concept	*N*
CTREL	Relate ones' own academic/skill portfolio with desirable career paths	188
CTSKIL	Indicate how different skill sets and predispositions relate to different career fields	190
CTSOLV	Apply written, verbal, and digital information to solve problems	216
CTTASK	Analyze simple and complex written instructions to perform a task	240
GRITADV	Use one's own discernment, empathy, and grit in communication and goal setting	229
GRITDISC	Use one's own discernment, empathy, and grit in communication and goal setting	188
GRITEXPT	Acknowledge expertise/experience as beneficial qualities to seek in career advisors	187
GRITINIT	Take the initiative to seek out career information and discuss it	239
GRITPRST	Acknowledge the importance of persistence and follow through	230
GRITVALU1	Analyze ones' own self values, skills, apprehensions, fears, knowledge, and incompatible work settings, and how these things play a role in ones' success within a particular position	187
GRITVALU2	Analyze ones' own self values, skills, apprehensions, fears, knowledge, and incompatible work settings, and how these things play a role in ones' success within a particular position	186
SELAPP	Complete a job application	190
SELARTG	Articulate ones' own skills/values, transferable skills, and career goals	189
SELBIAS	Knowledge of your own bias and its impact on your assumptions and interpretations	190
SELDISC	Communicte personal career interests and disc career opportunities with prospective employers	223
SELDVRS	Work collaboratively with diverse groups	203
SELELEM1	Knowledge of the elements of good teamwork, as well as the importance of working on a team	202

Item ID	Career Literacy Skill/Concept	*N*
SELELEM2	Knowledge of the elements of good teamwork, as well as the importance of working on a team	199
SELELEM3	Knowledge of the elements of good teamwork, as well as the importance of working on a team	202
SELETIQ1	Interpret professional etiquette expectations (communication, attire, topics, etc.), as well as how those expectations may vary from one career to another	230
SELETIQ2	Interpret professional etiquette expectations (communication, attire, topics, etc.), as well as how those expectations may vary from one career to another	223
SELREF	Contact, obtain permission, and prepare a list of professional references appropriate for a specific job opportunity	223
SELVIEW	View things from others' perspectives, understanding that inters with others often have little to do with oneself and more to do with others	185

Note. N = number of observations.

APPENDIX D INTERVIEW PROTOCOL

The purpose of this talk is to find out what you were thinking while you took the assessment about Career Literacy. Your thoughts will be used to help make the assessment useful for other students in middle and high school. Your answers are important to for to create the best tool possible. One day something like this might be useful to you and your family, in addition to your teachers and counselor.

When I am finished with the test the results might help parents, teachers, and counselors choose activities that will build students' skills and help them prepare to make critical decisions about their life after high school.

Please feel free to share details freely. The more details you provide, the more I will be able to make the test better for those will take it.

Your comments will remain anonymous and neither your name, your school district or your location will be mentioned in anything I write. You will be identified by a number indicating your grade.

Your participation is voluntary, and you choose to stop at any time, even after we get started.

Interview begins:
Thank you again for agreeing to participate in this conversation. Before we get started, do you have any questions for me? Ok, here's the first question.

Questions:

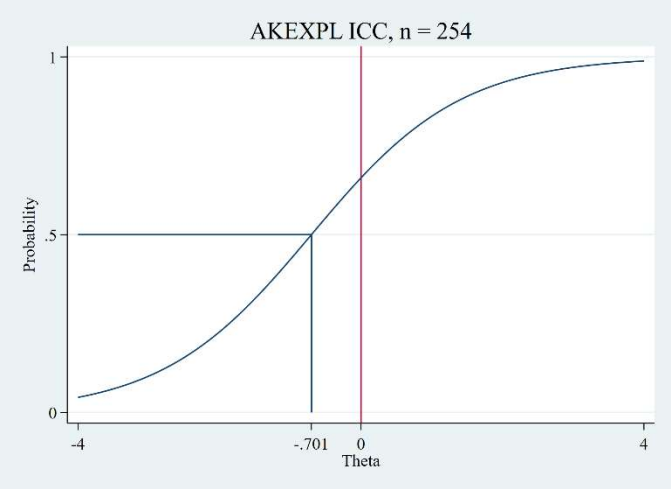
1. How helpful were the directions you received for getting to and taking the assessment?
2. How do you feel about the assessment you just took?
3. How would you describe the difficulty?
4. How did you feel answering the questions in the end that asked about you and your experience?
5. Please describe any questions that you found confusing. What made it confusing?
6. What else do you think I need to know about your experience taking this test? Is there something that would have made things better or easier for you?

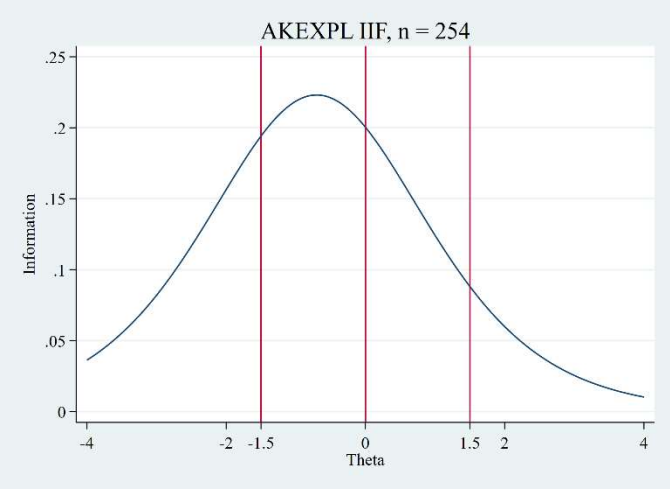
Thank you so much for taking the time to answer my questions. This information will be very helpful to all who take this after you.

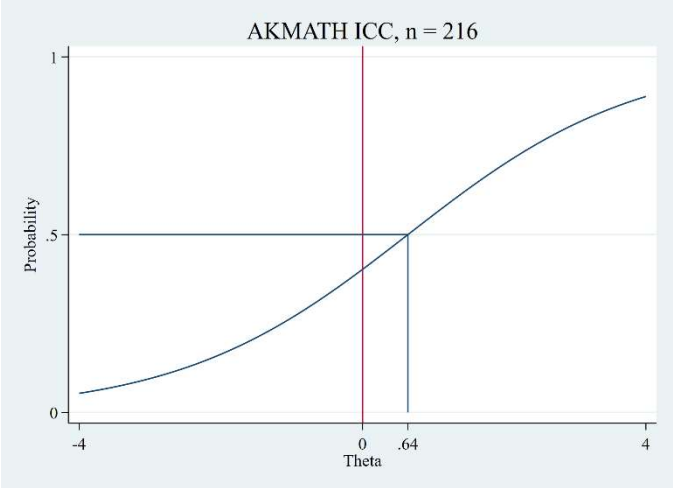
APPENDIX E RESULTS OF PRINCIPAL COMPONENTS ANALYSIS

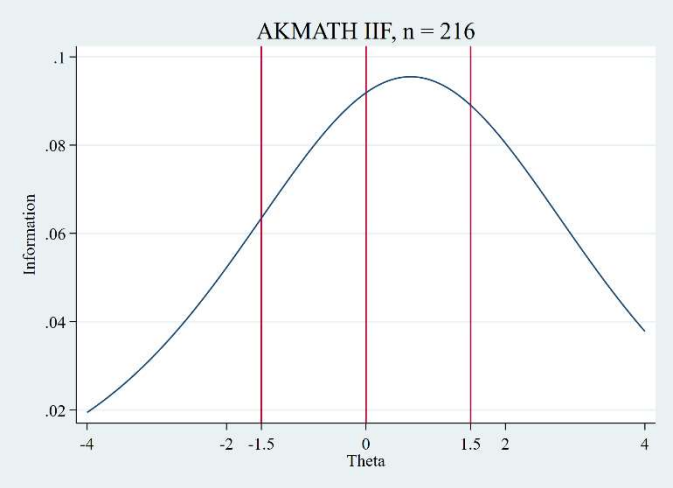
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	13.87	11.16	0.34	0.34
Factor2	2.71	0.66	0.07	0.40
Factor3	2.05	0.13	0.05	0.45
Factor4	1.92	0.12	0.05	0.50
Factor5	1.80	0.18	0.04	0.55
Factor6	1.62	0.09	0.04	0.58
Factor7	1.52	0.16	0.04	0.62
Factor8	1.37	0.02	0.03	0.66
Factor9	1.35	0.19	0.03	0.69
Factor10	1.15	0.04	0.03	0.72
Factor11	1.11	0.10	0.03	0.74
Factor12	1.01	0.02	0.02	0.77
Factor13	0.99	0.12	0.02	0.79
Factor14	0.86	0.04	0.02	0.81
Factor15	0.83	0.03	0.02	0.83
Factor16	0.80	0.11	0.02	0.85
Factor17	0.68	0.06	0.02	0.87
Factor18	0.62	0.02	0.02	0.88
Factor19	0.60	0.04	0.01	0.90
Factor20	0.55	0.06	0.01	0.91
Factor21	0.50	0.02	0.01	0.92
Factor22	0.47	0.08	0.01	0.94
Factor23	0.39	0.01	0.01	0.95
Factor24	0.38	0.03	0.01	0.95
Factor25	0.35	0.04	0.01	0.96
Factor26	0.31	0.01	0.01	0.97
Factor27	0.29	0.07	0.01	0.98
Factor28	0.23	0.02	0.01	0.98
Factor29	0.21	0.02	0.01	0.99
Factor30	0.18	0.06	0.00	0.99
Factor31	0.12	0.04	0.00	1.00
Factor32	0.09	0.02	0.00	1.00
Factor33	0.07	0.06	0.00	1.00
Factor34	0.01	0.01	0.00	1.00
Factor35	0.00	0.00	0.00	1.00
Factor36	0.00	0.00	0.00	1.00
Factor37	0.00	0.00	0.00	1.00
Factor38	0.00	0.00	0.00	1.00
Factor39	0.00	0.00	0.00	1.00

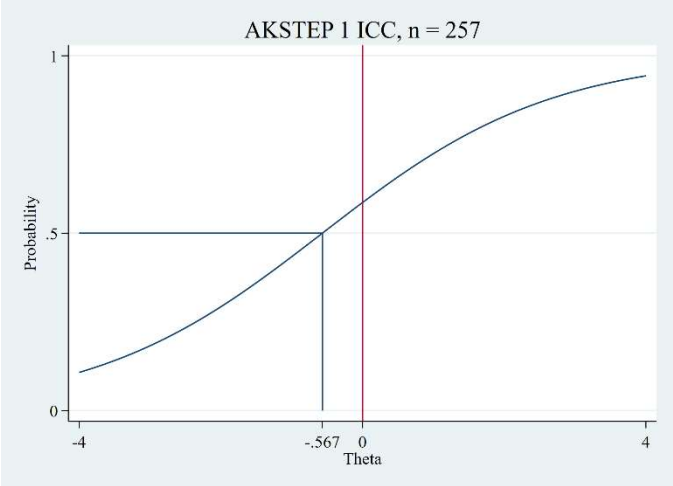
APPENDIX F 2PL ICC IIF GRAPHS ALL ITEMS

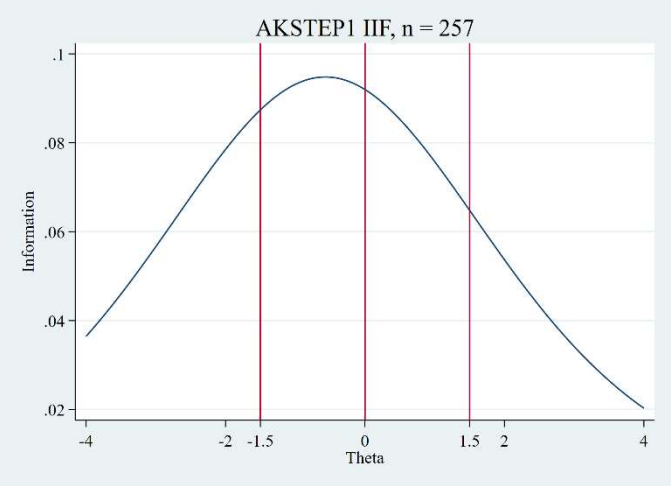


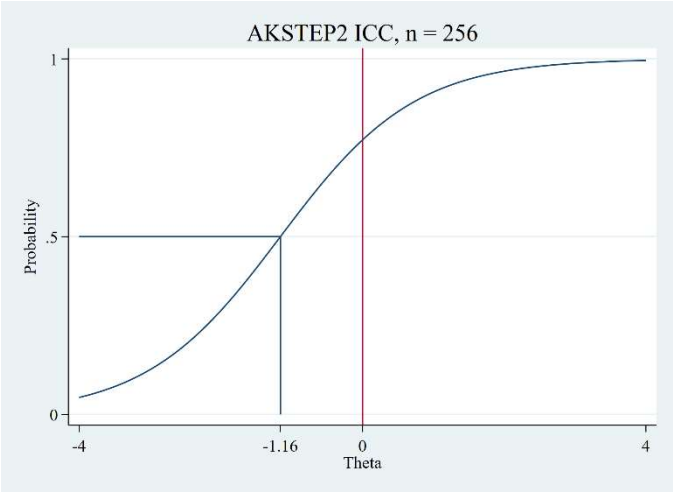


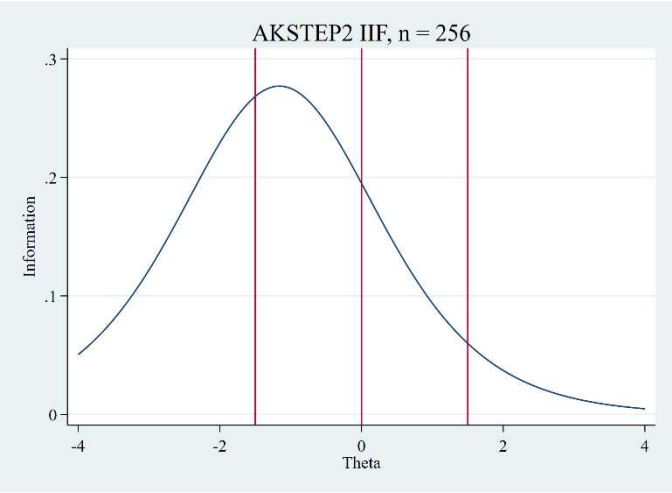


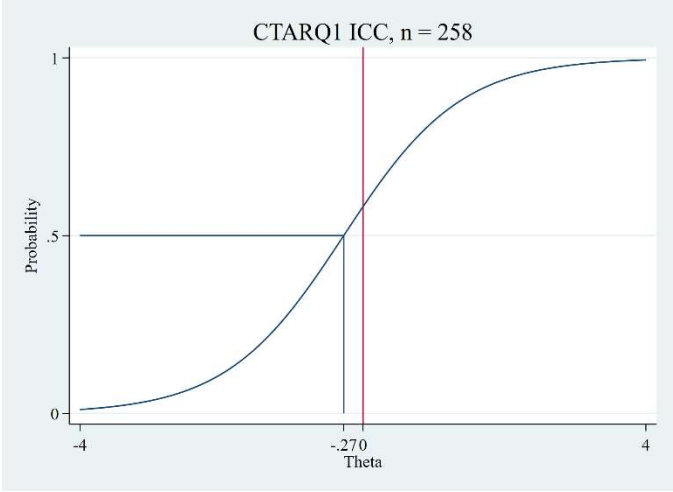


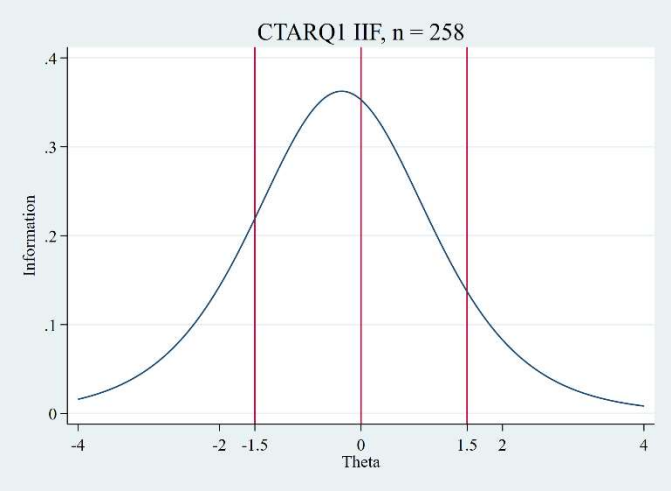


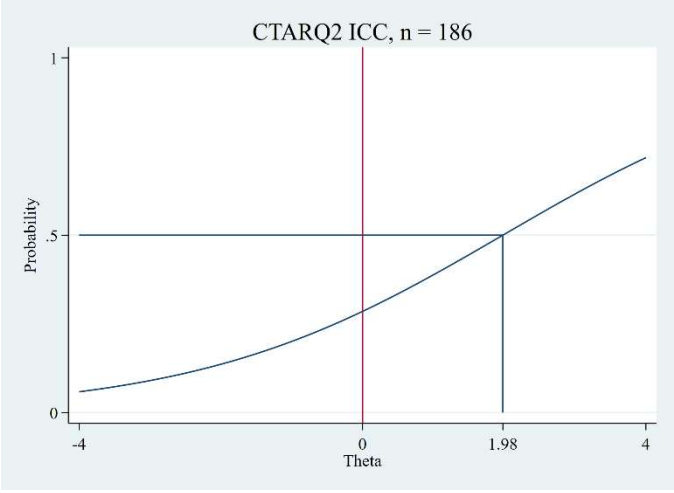


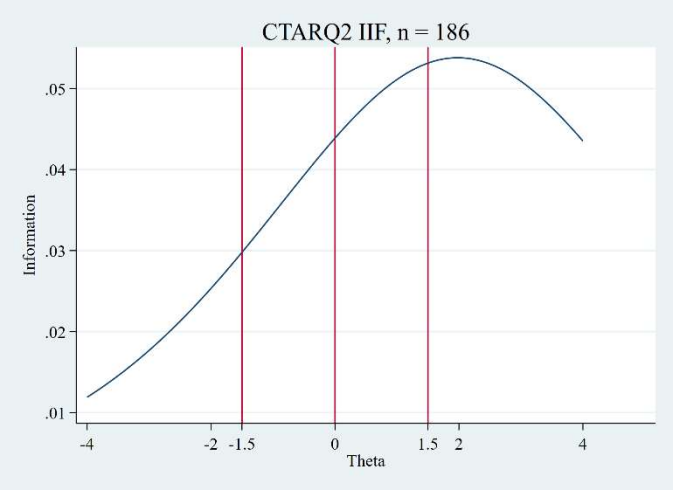

AKSTEP2 ICC, n = 256
Probability
1
.5
0
-4
-1.16
0
4
Theta

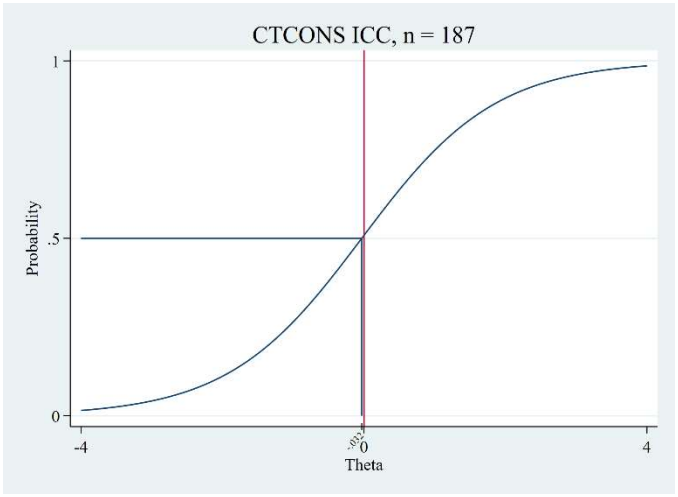

AKSTEP2 IIF, n = 256
Information
.3
.2
.1
0
-4
-2
0
2
4
Theta

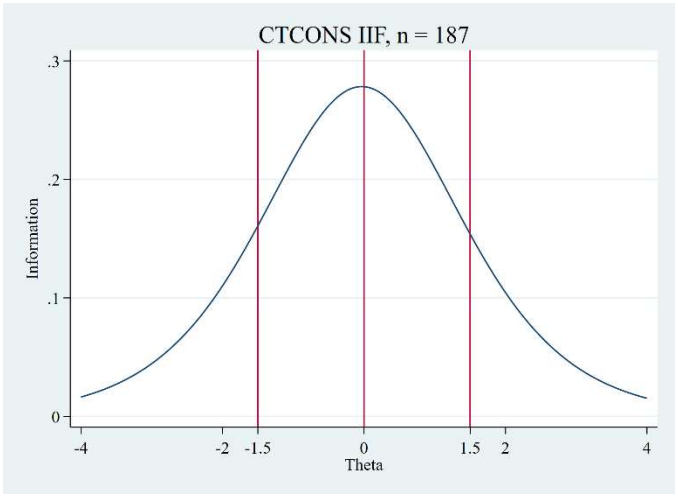

CTARQ1 ICC, n = 258
Probability
1
.5
0
-4
-.270
4
Theta

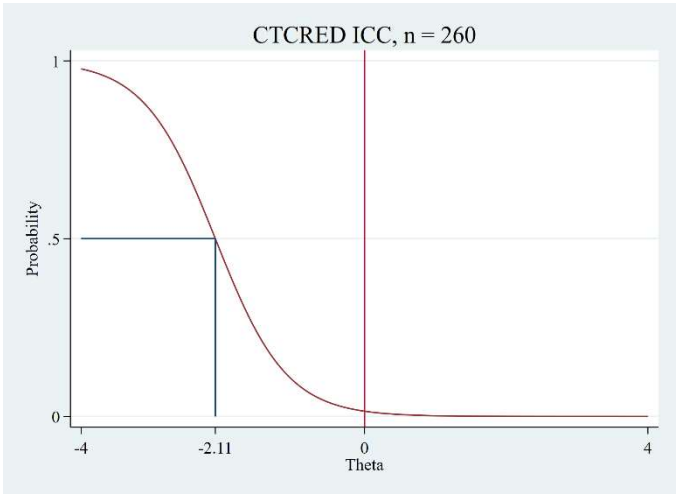

CTARQ1 IIF, n = 258
Information
.4
.3
.2
.1
0
-4
-2
-1.5
0
1.5
2
4
Theta

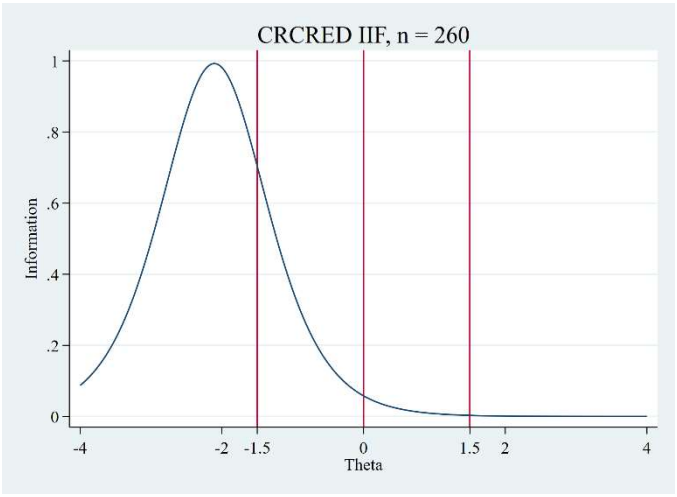

CTARQ2 ICC, n = 186
Probability
1
.5
0
-4
0
1.98
4
Theta

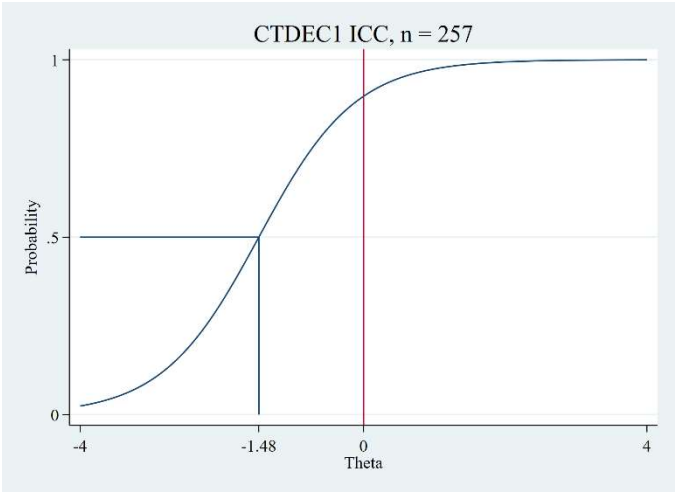

CTARQ2 IIF, n = 186
Information
.05
.04
.03
.02
.01
-4
-2
-1.5
0
1.5
2
4
Theta

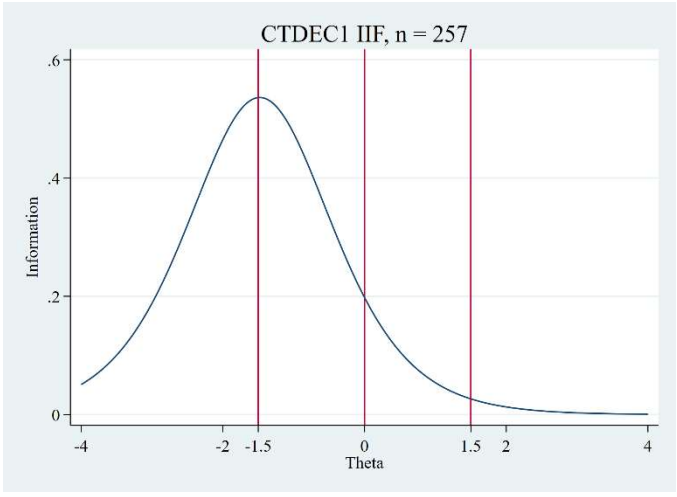

CTCONS ICC, n = 187
Probability
1
.5
0
-4
0
4
Theta

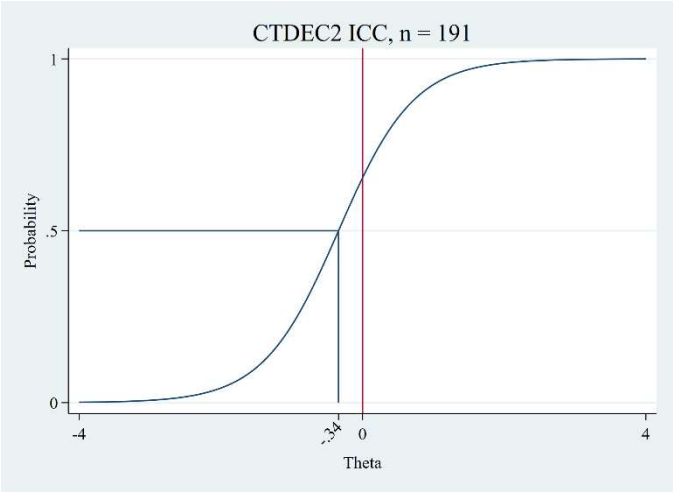

CTCONS IIF, n = 187
Information
.3
.2
.1
0
-4
-2
-1.5
0
1.5
2
4
Theta

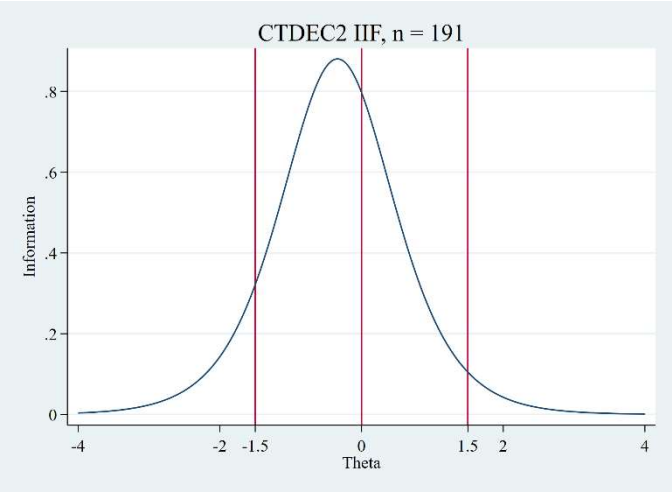

CTCRED ICC, n = 260
Probability
1
.5
0
-4
-2.11
0
4
Theta

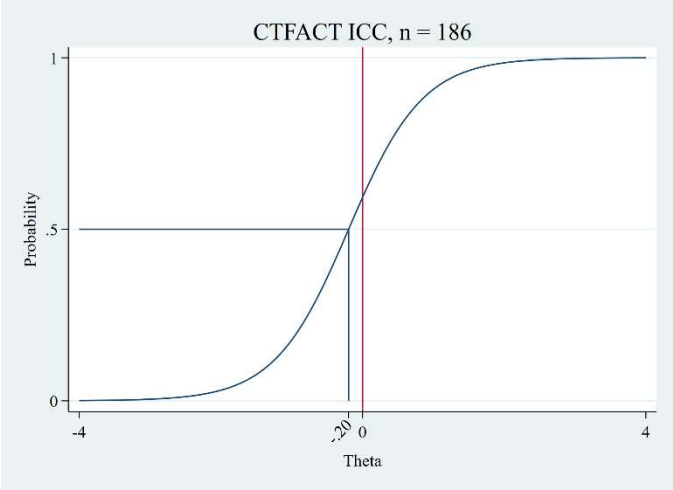

CRCRED IIF, n = 260
Information
1
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

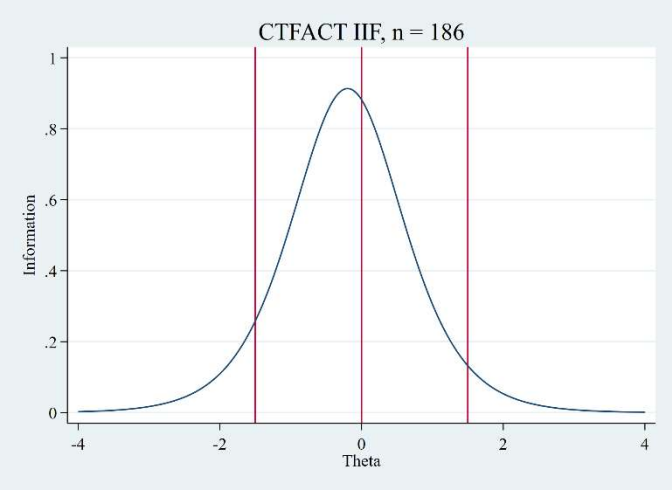

CTDEC1 ICC, n = 257
Probability
1
.5
0
-4
-1.48
0
4
Theta

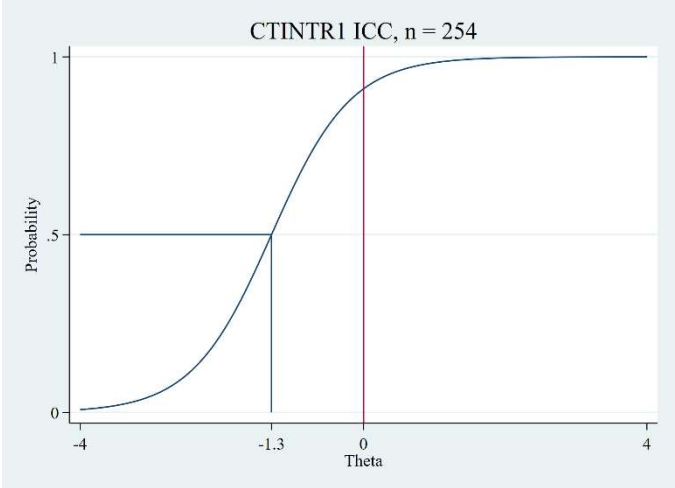

CTDEC1 IIF, n = 257
Information
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

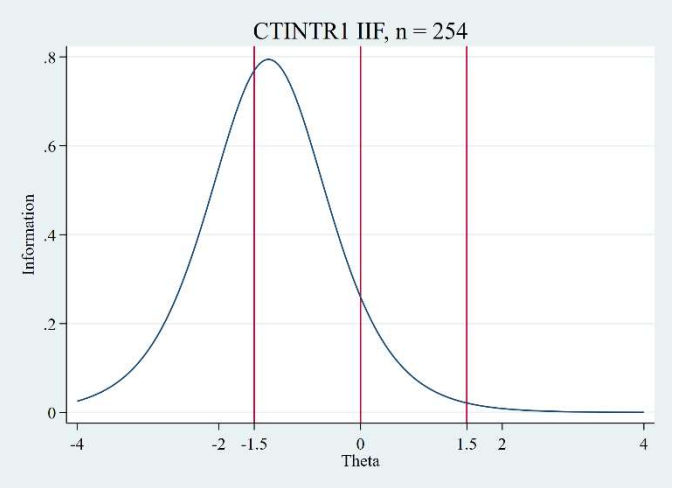

CTDEC2 ICC, n = 191
Probability
1
.5
0
-4
-.34
0
4
Theta

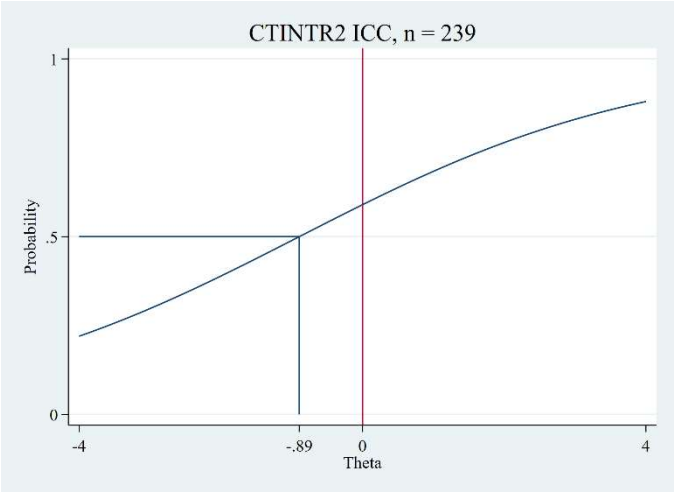

CTDEC2 IIF, n = 191
Information
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

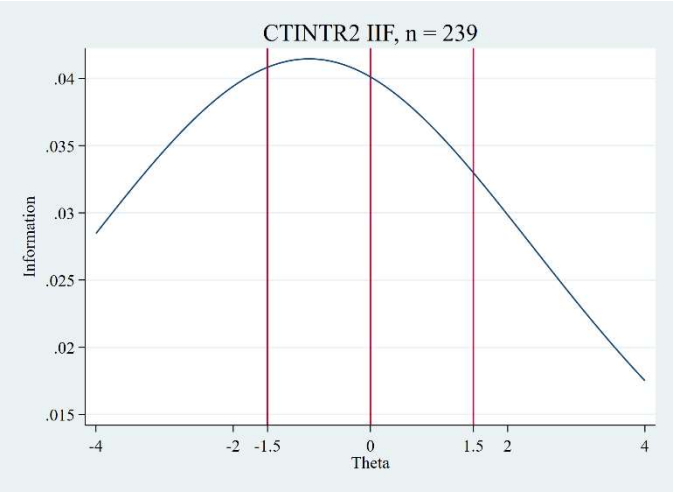

CTFACT ICC, n = 186
Probability
1
.5
0
-4
-.20
0
4
Theta

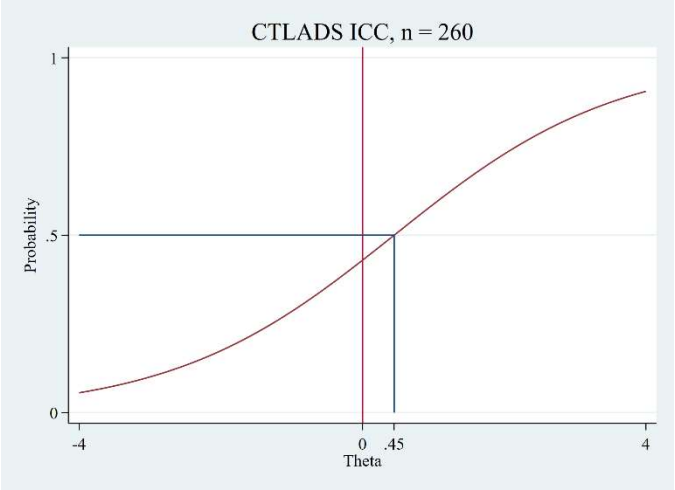

CTFACT IIF, n = 186
Information
1
.8
.6
.4
.2
0
-4
-2
0
2
4
Theta

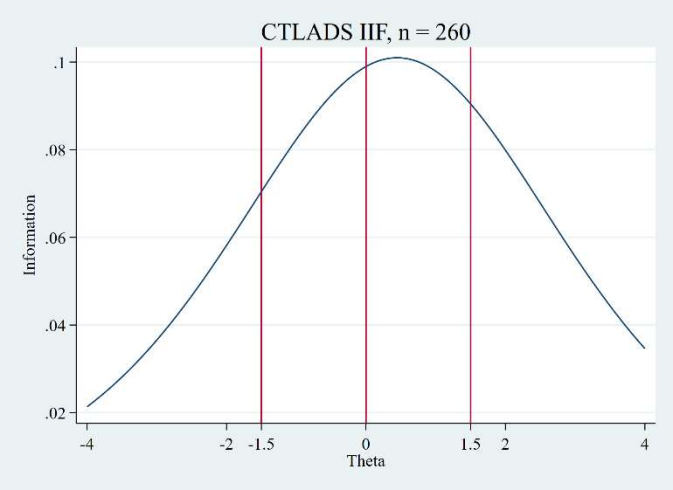

CTINTR1 ICC, n = 254
Probability
1
.5
0
-4
-1.3
0
4
Theta

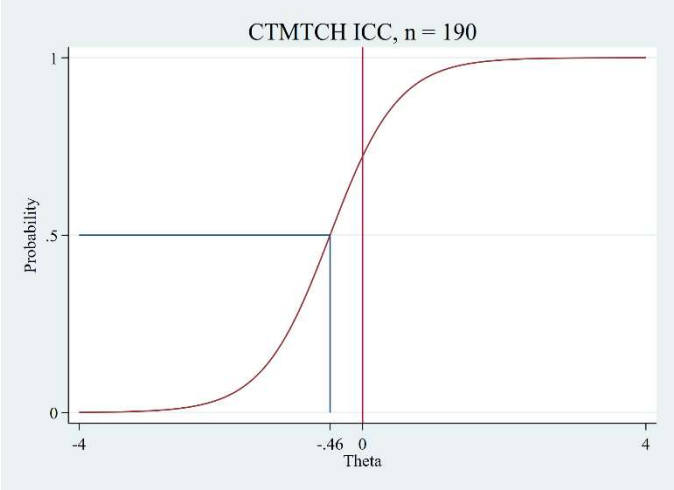

CTINTR1 IIF, n = 254
Information
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

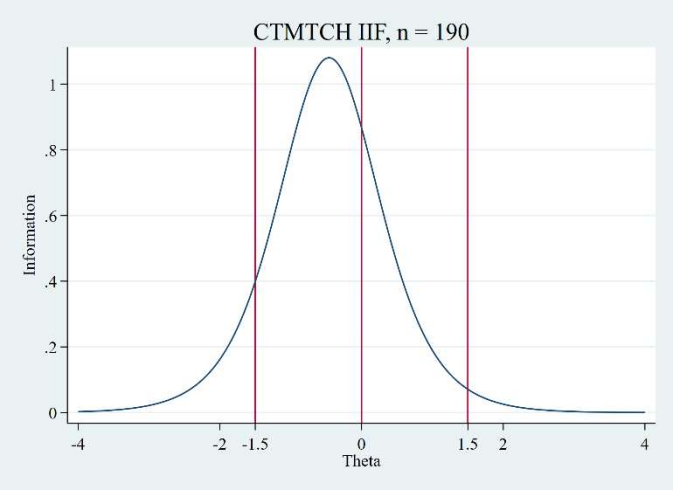

CTINTR2 ICC, n = 239
Probability
1
.5
0
-4
-.89
0
4
Theta

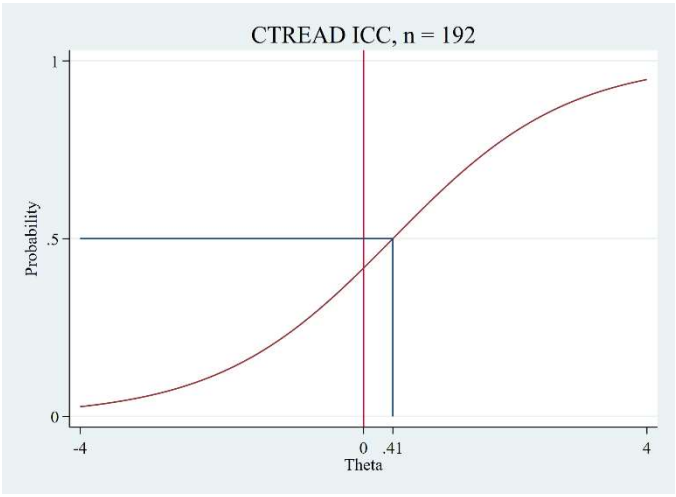

CTINTR2 IIF, n = 239
Information
.04
.035
.03
.025
.02
.015
-4
-2
-1.5
0
1.5
2
4
Theta

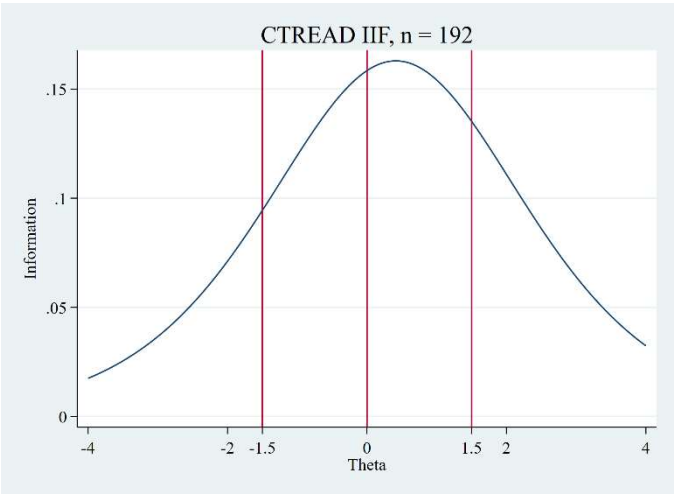

CTLADS ICC, n = 260
Probability
1
.5
0
-4
0
.45
4
Theta

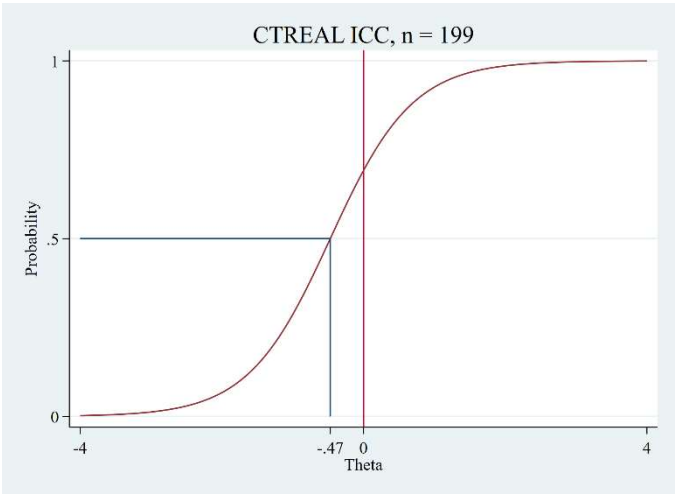

CTLADS IIF, n = 260
Information
.1
.08
.06
.04
.02
-4
-2
-1.5
0
1.5
2
4
Theta

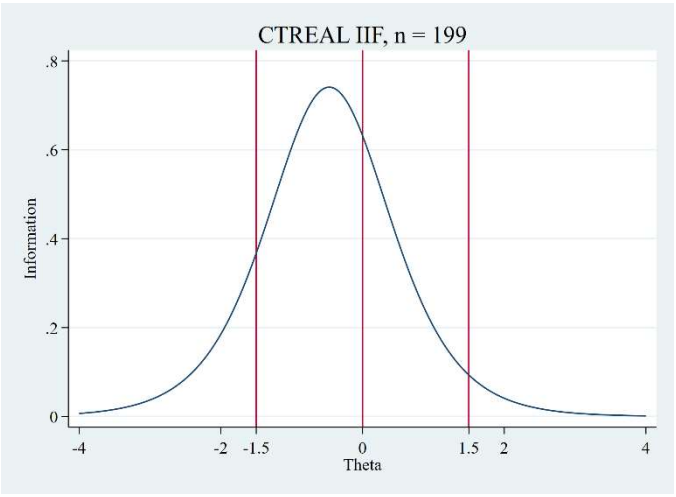

CTMTCH ICC, n = 190
Probability
1
.5
0
-4
-.46
0
4
Theta

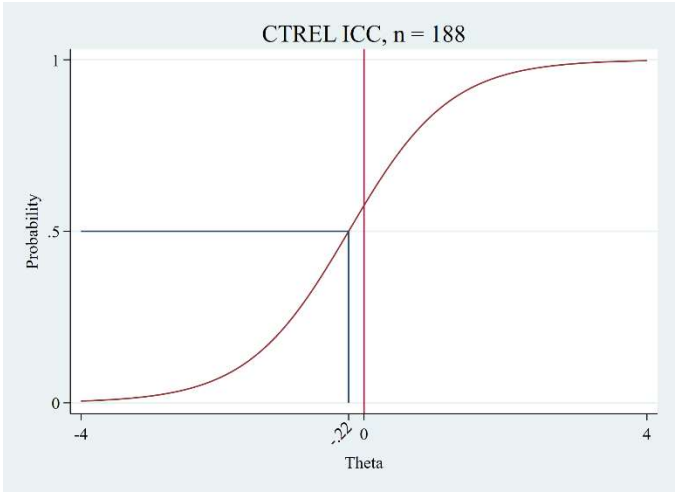

CTMTCH IIF, n = 190
Information
1
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

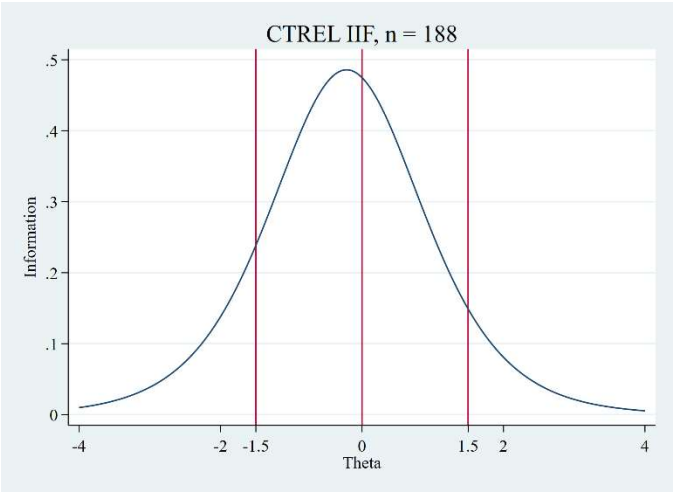

CTREAD ICC, n = 192
Probability
1
.5
0
-4
0
.41
4
Theta

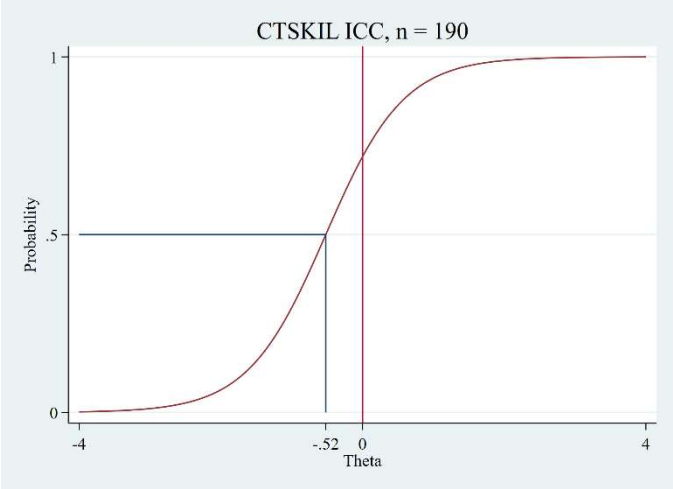

CTREAD IIF, n = 192
Information
.15
.1
.05
0
-4
-2
-1.5
0
1.5
2
4
Theta

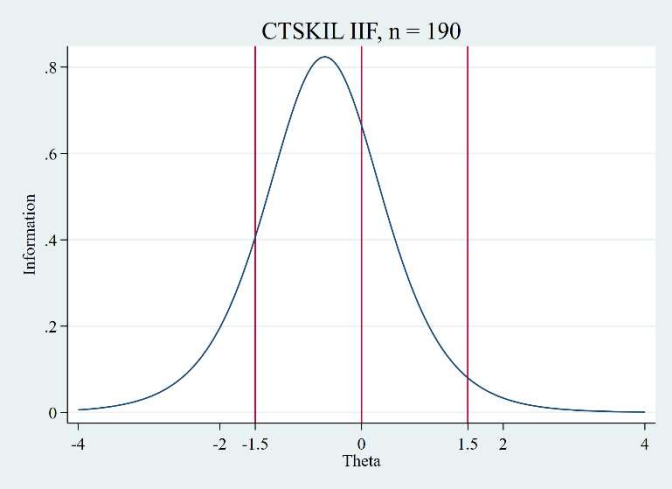

CTREAL ICC, n = 199
Probability
1
.5
0
-4
-.47
0
4
Theta

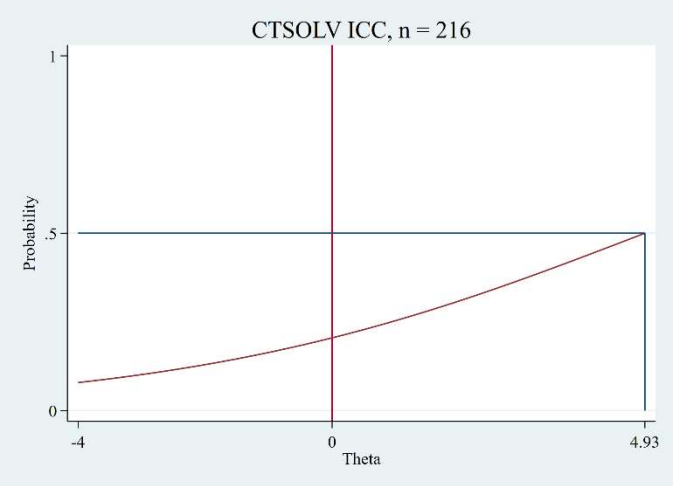

CTREAL IIF, n = 199
Information
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

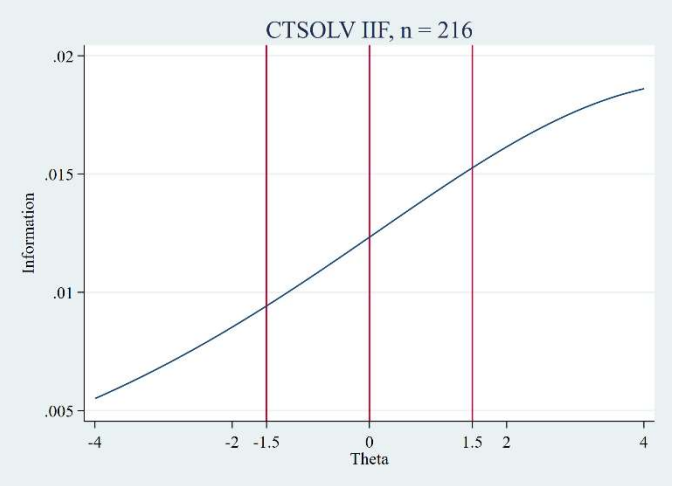

CTREL ICC, n = 188
Probability
1
.5
0
-4
-.22
0
4
Theta

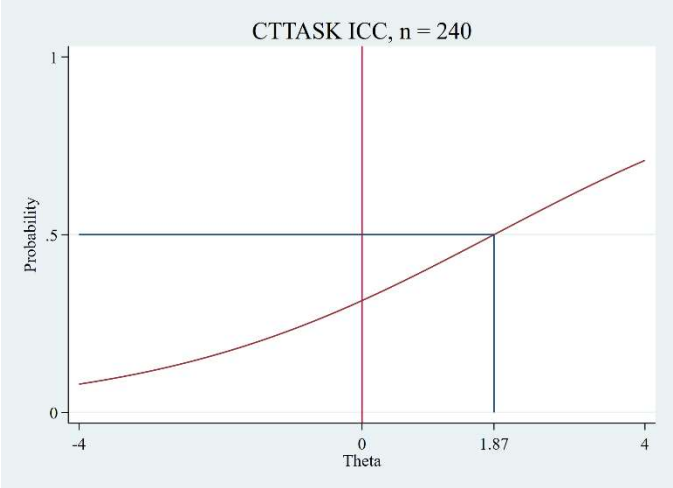

CTREL IIF, n = 188
Information
.5
.4
.3
.2
.1
0
-4
-2
-1.5
0
1.5
2
4
Theta

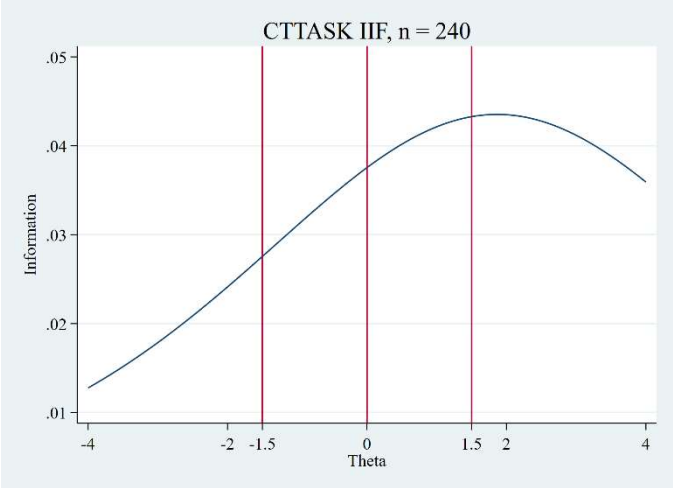

CTSKIL ICC, n = 190
Probability
1
.5
0
-4
-.52
0
4
Theta

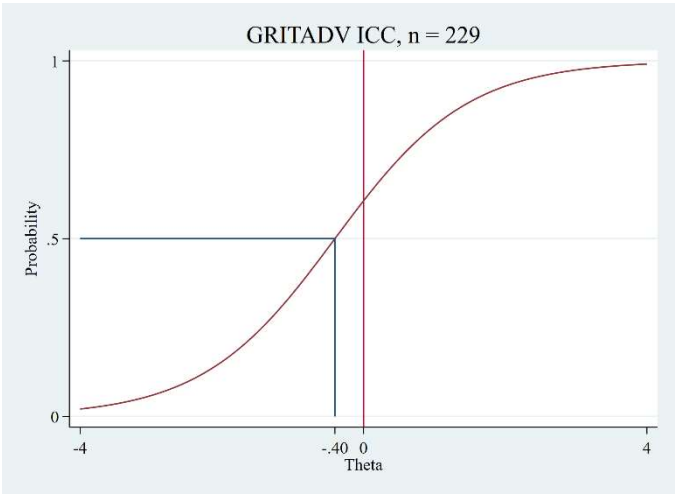

CTSKIL IIF, n = 190
Information
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

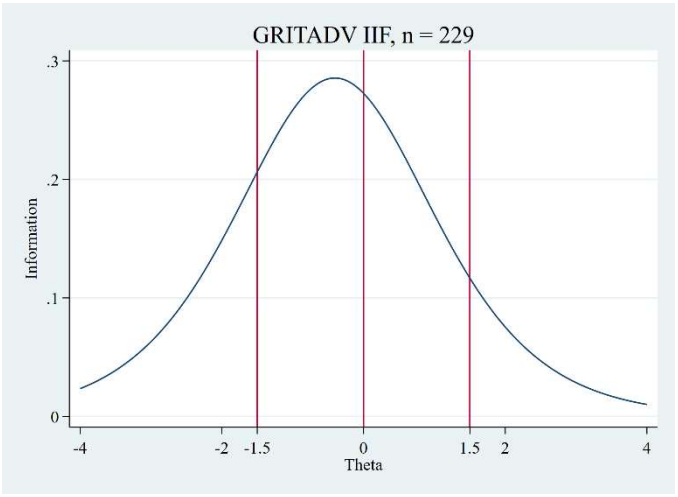

CTSOLV ICC, n = 216
Probability
1
.5
0
-4
0
4.93
Theta

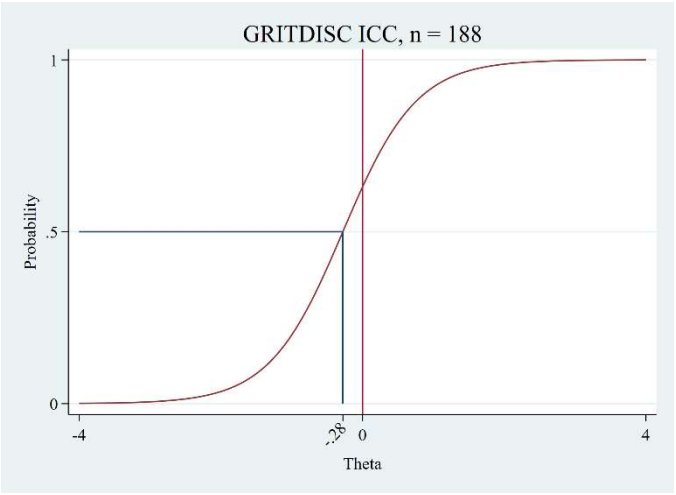

CTSOLV IIF, n = 216
Information
.02
.015
.01
.005
-4
-2
-1.5
0
1.5
2
4
Theta

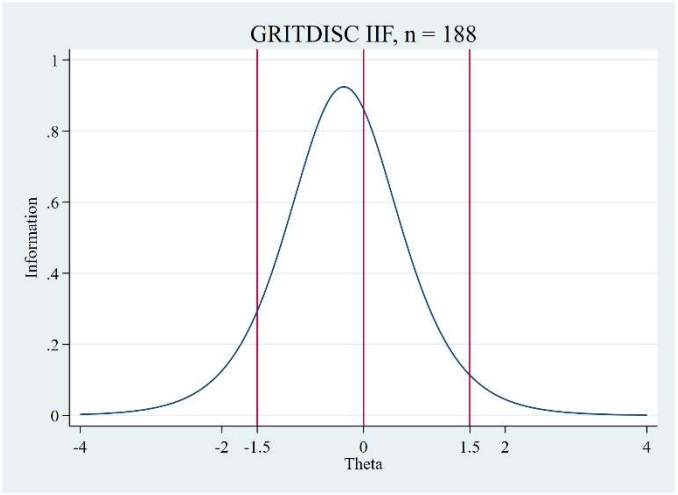

CTTASK ICC, n = 240
Probability
1
.5
0
-4
0
1.87
4
Theta

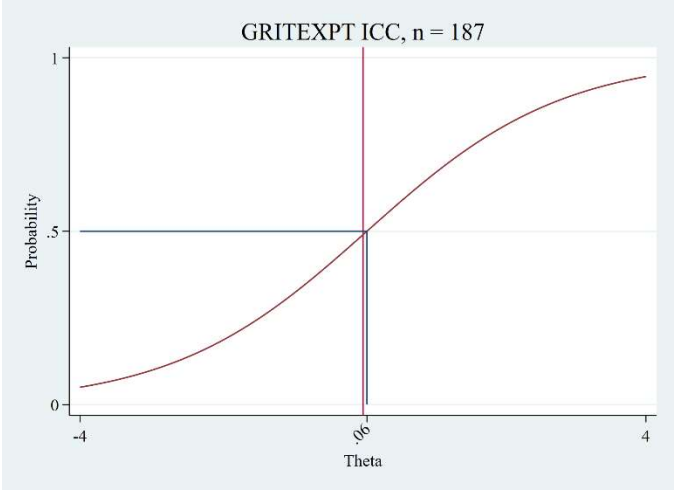

CTTASK IIF, n = 240
Information
.05
.04
.03
.02
.01
-4
-2
-1.5
0
1.5
2
4
Theta

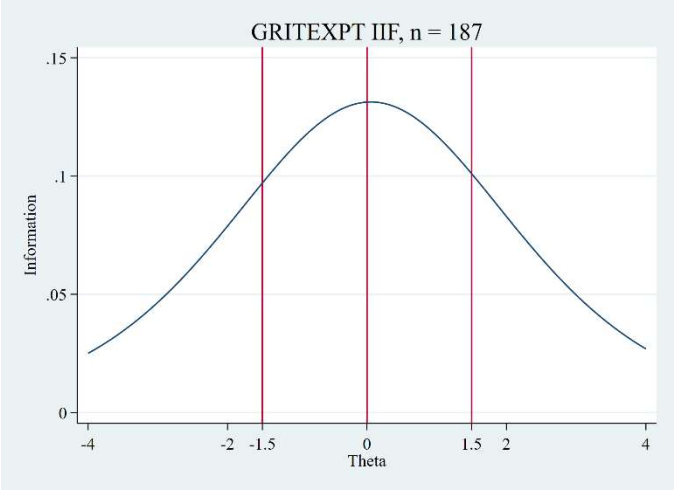

GRITADV ICC, n = 229
Probability
1
.5
0
-4
-.40
0
4
Theta

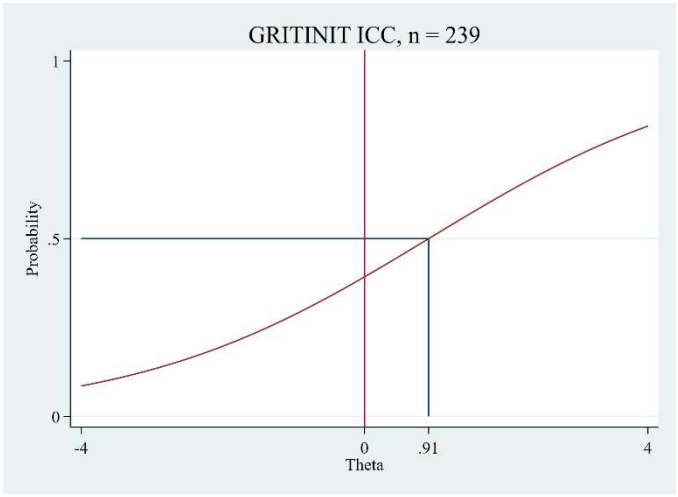

GRITADV IIF, n = 229
Information
.3
.2
.1
0
-4
-2
-1.5
0
1.5
2
4
Theta


GRITDISC ICC, n = 188
Probability
1
.5
0
-4
-.28
0
4
Theta

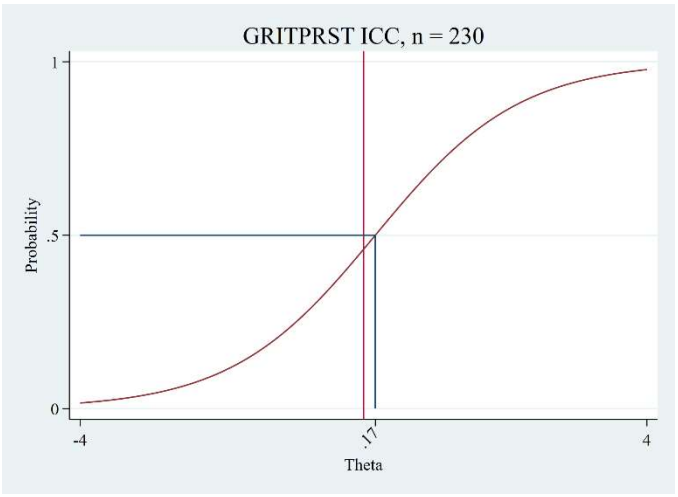

GRITDISC IIF, n = 188
Information
1
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

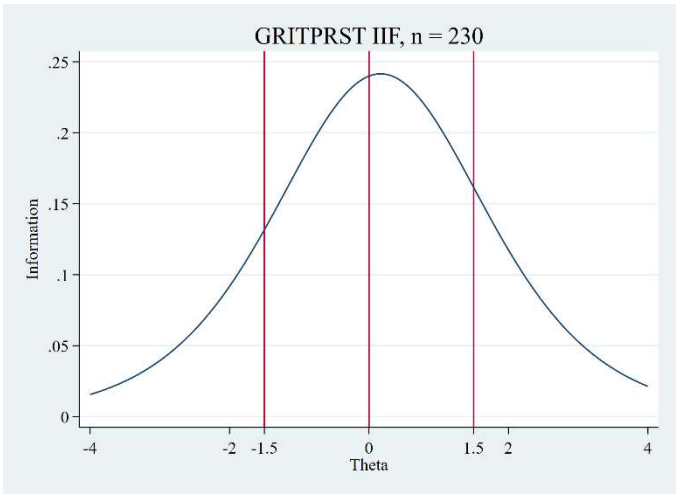

GRITEXPT ICC, n = 187
Probability
1
.5
0
-4
.06
4
Theta

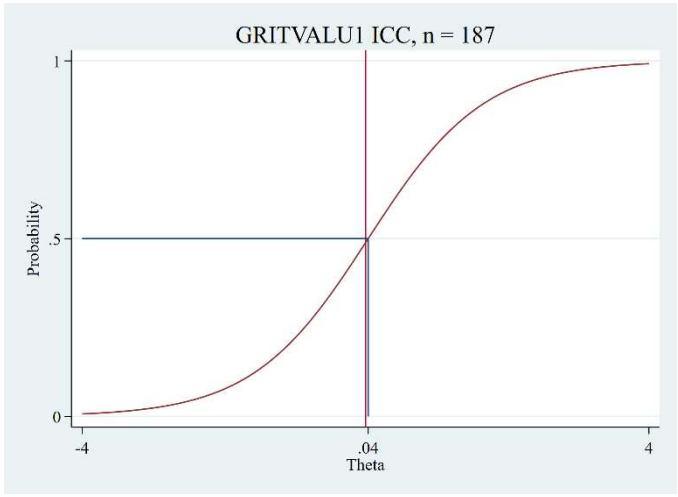

GRITEXPT IIF, n = 187
Information
.15
.1
.05
0
-4
-2
-1.5
0
1.5
2
4
Theta

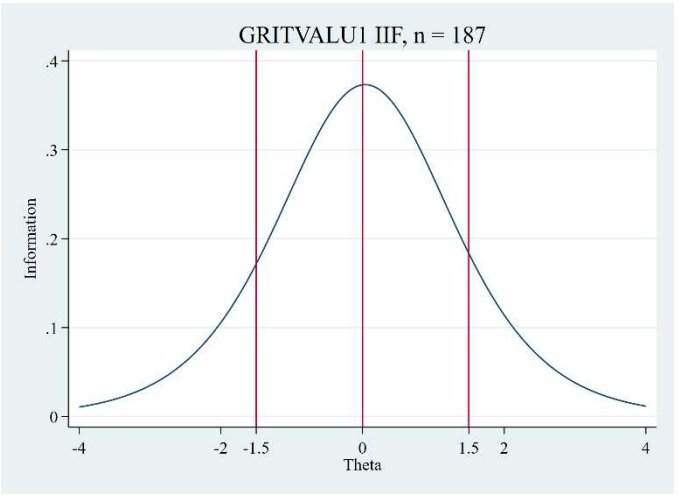

GRITINIT ICC, n = 239
Probability
1
.5
0
-4
0
.91
4
Theta

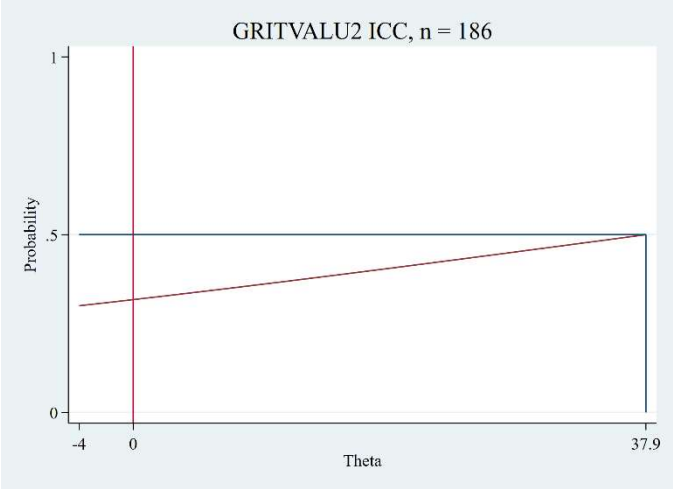

GRITINIT IIF, n = 239
Information
.06
.05
.04
.03
.02
-4
-2
-1.5
0
1.5
2
4
Theta

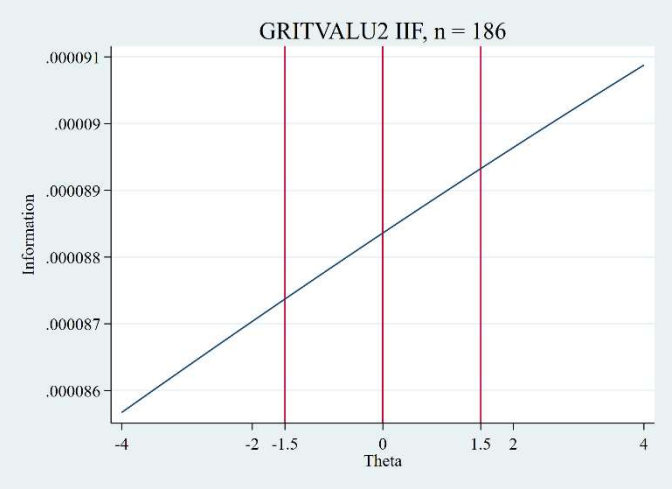

GRITPRST ICC, n = 230
Probability
1
.5
0
-4
.17
4
Theta

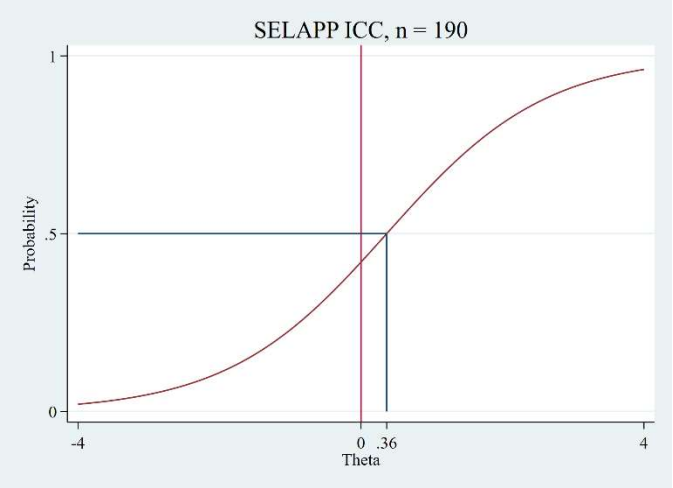

GRITPRST IIF, n = 230
Information
.25
.2
.15
.1
.05
0
-4
-2
-1.5
0
1.5
2
4
Theta

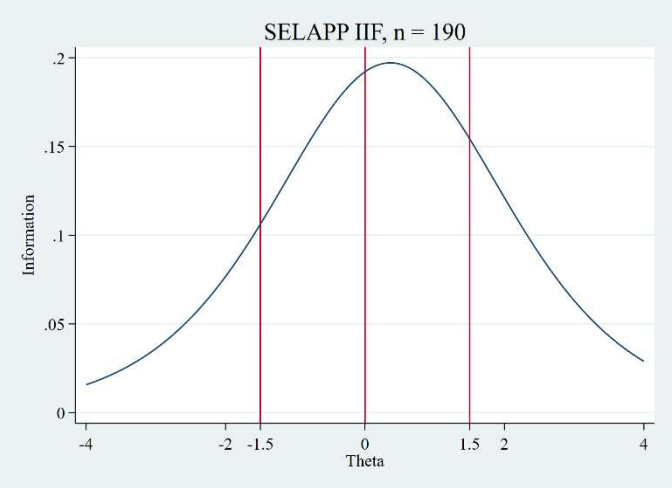

GRITVALU1 ICC, n = 187
Probability
1
.5
0
-4
.04
4
Theta

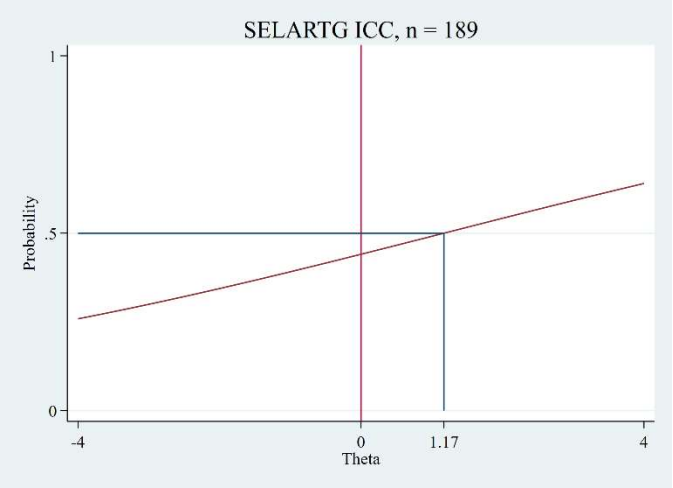

GRITVALU1 IIF, n = 187
Information
.4
.3
.2
.1
0
-4
-2
-1.5
0
1.5
2
4
Theta

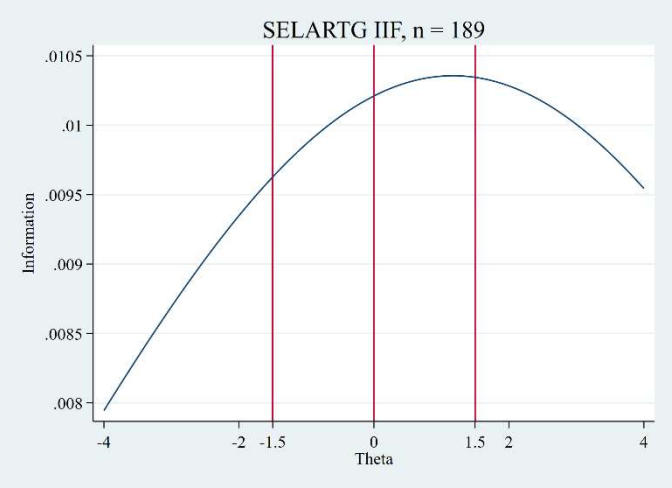

GRITVALU2 ICC, n = 186
Probability
1
.5
0
-4
0
37.9
Theta

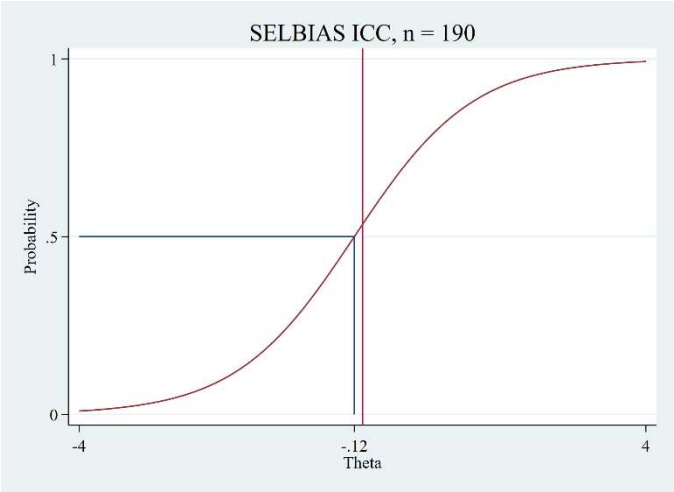

GRITVALU2 IIF, n = 186
Information
.000091
.00009
.000089
.000088
.000087
.000086
-4
-2
-1.5
0
1.5
2
4
Theta

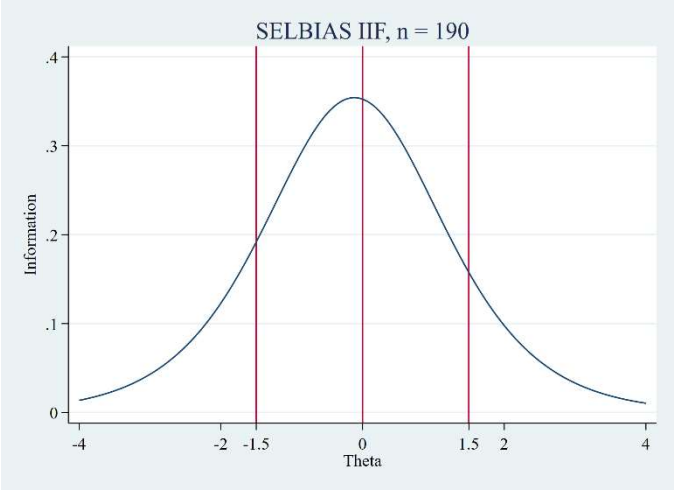

SELAPP ICC, n = 190
Probability
1
.5
0
-4
0
.36
4
Theta

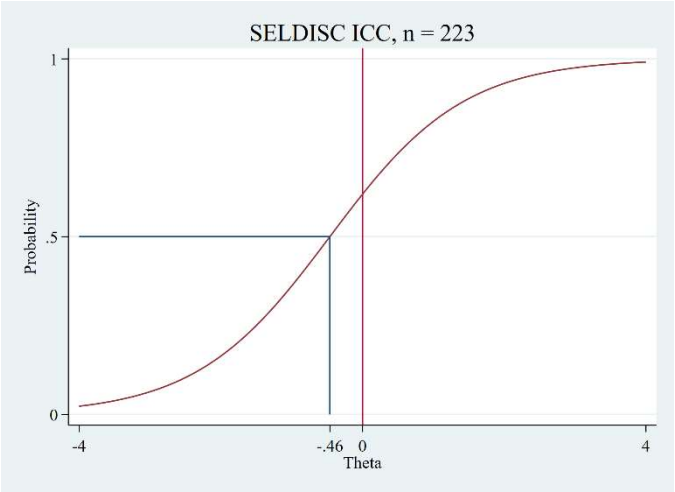

SELAPP IIF, n = 190
Information
.2
.15
.1
.05
0
-4
-2
-1.5
0
1.5
2
4
Theta

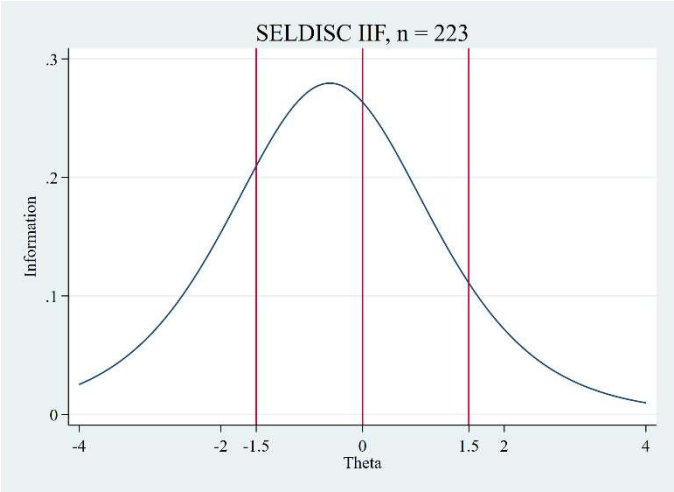

SELARTG ICC, n = 189
Probability
1
.5
0
-4
0
1.17
4
Theta

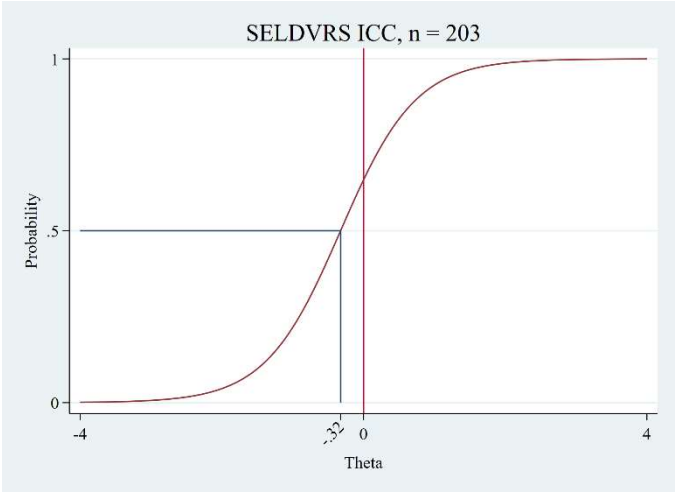

SELARTG IIF, n = 189
Information
.0105
.01
.0095
.009
.0085
.008
-4
-2
-1.5
0
1.5
2
4
Theta

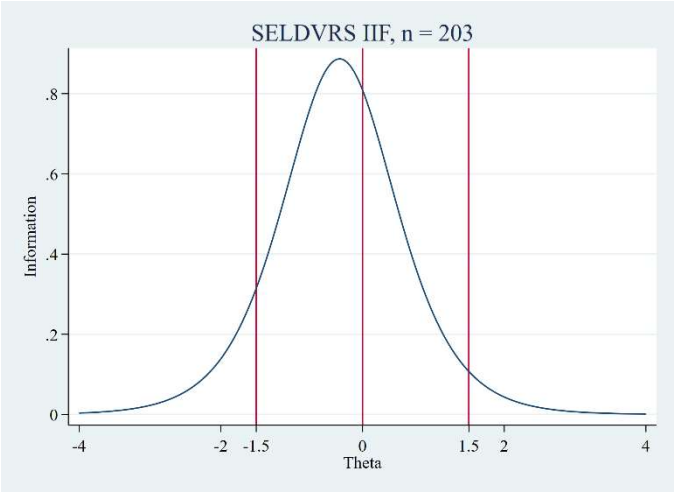

SELBIAS ICC, n = 190
Probability
1
.5
0
-4
-.12
4
Theta

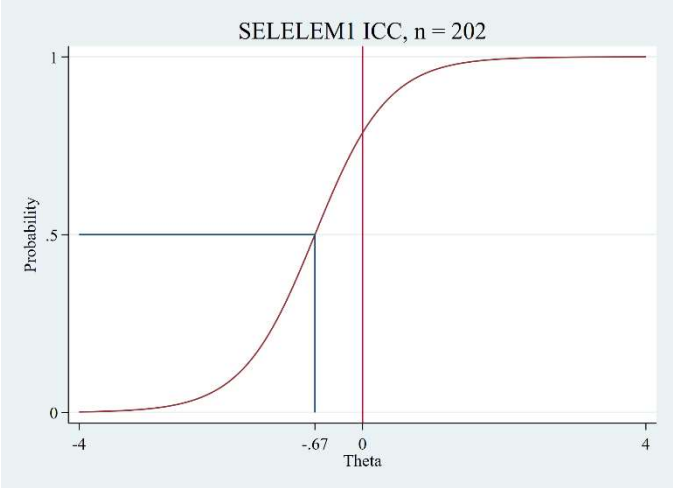

SELBIAS IIF, n = 190
Information
.4
.3
.2
.1
0
-4
-2
-1.5
0
1.5
2
4
Theta

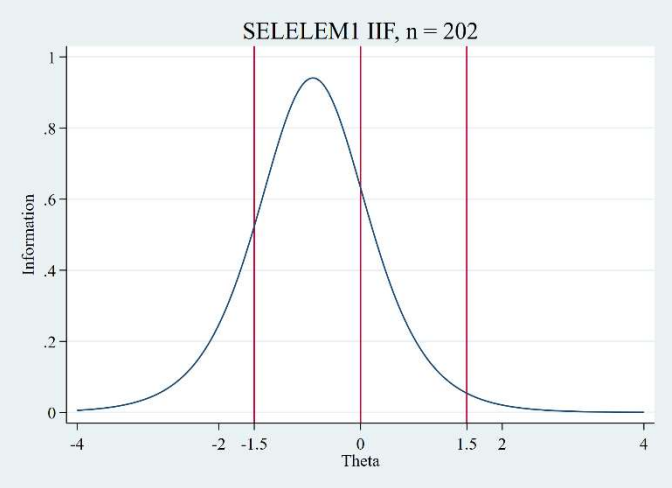

SELDISC ICC, n = 223
Probability
1
.5
0
-4
-.46
0
4
Theta

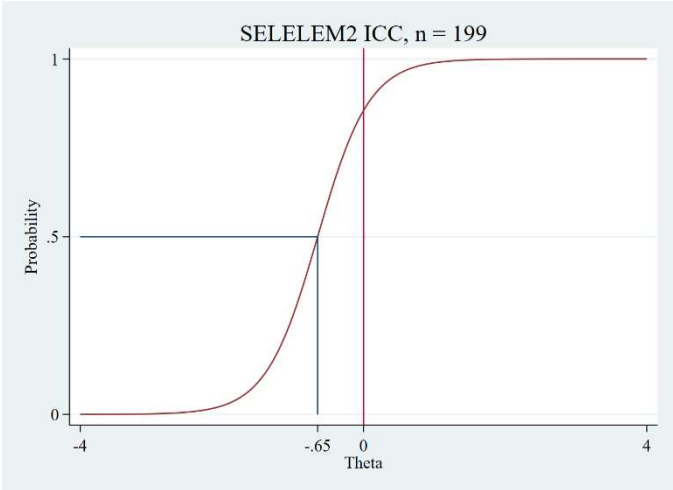

SELDISC IIF, n = 223
Information
.3
.2
.1
0
-4
-2
-1.5
0
1.5
2
4
Theta

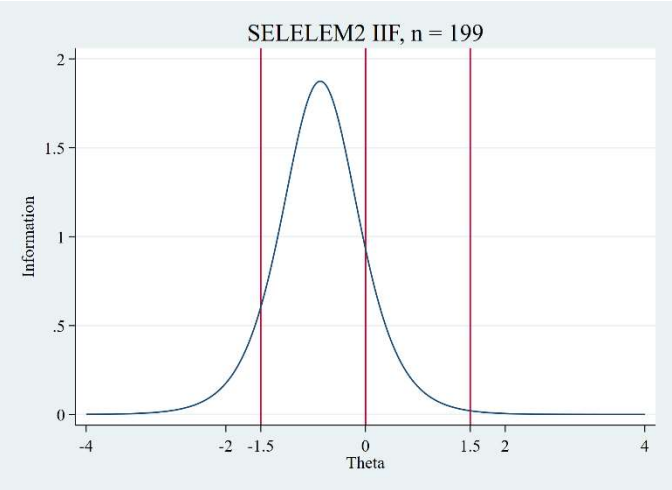

SELDVRS ICC, n = 203
Probability
1
.5
0
-4
-.32
0
4
Theta

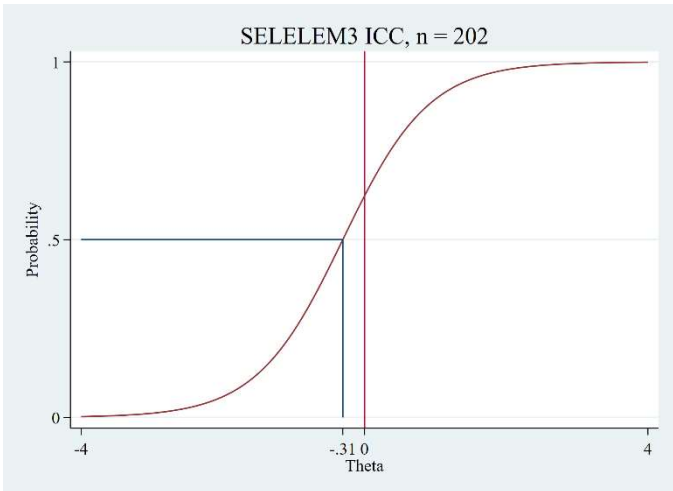

SELDVRS IIF, n = 203
Information
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

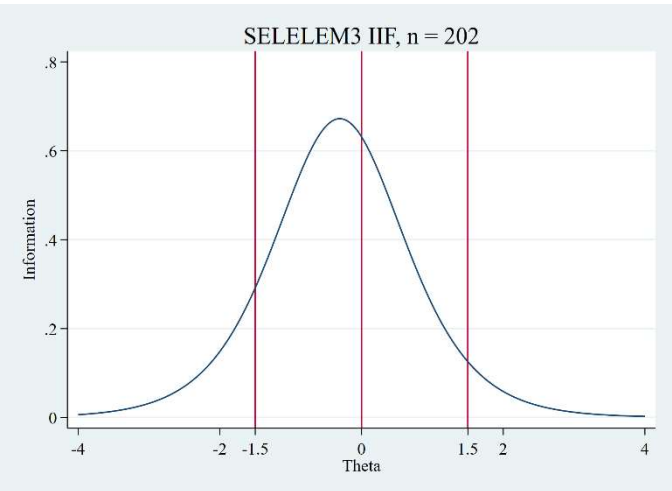

SELELEM1 ICC, n = 202
Probability
1
.5
0
-4
-.67
0
4
Theta

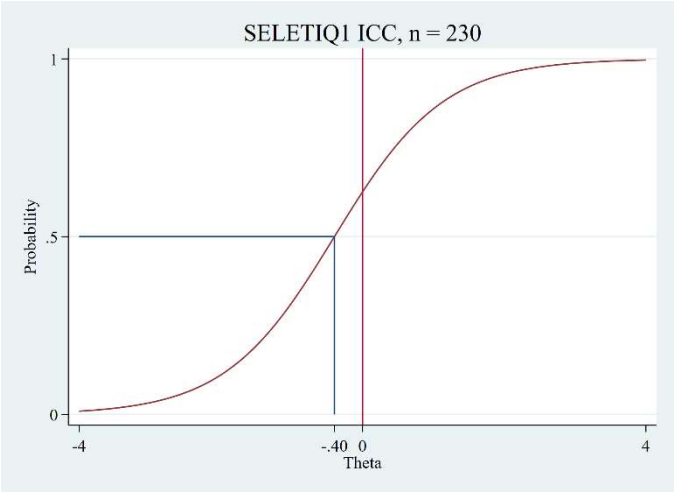

SELELEM1 IIF, n = 202
Information
1
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

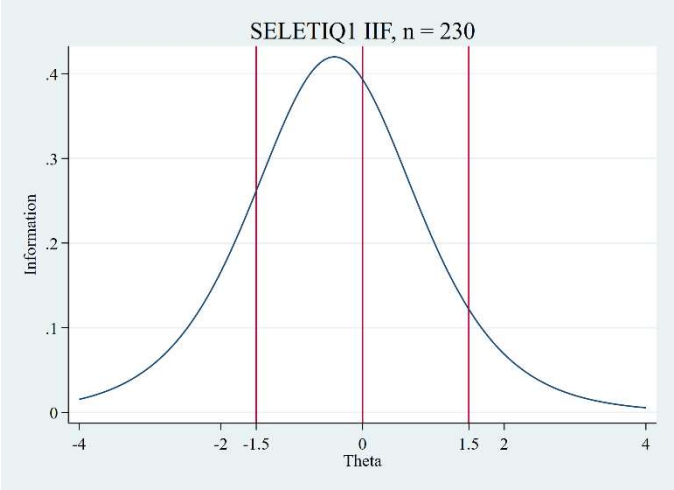

SELELEM2 ICC, n = 199
Probability
1
.5
0
-4
-.65
0
4
Theta

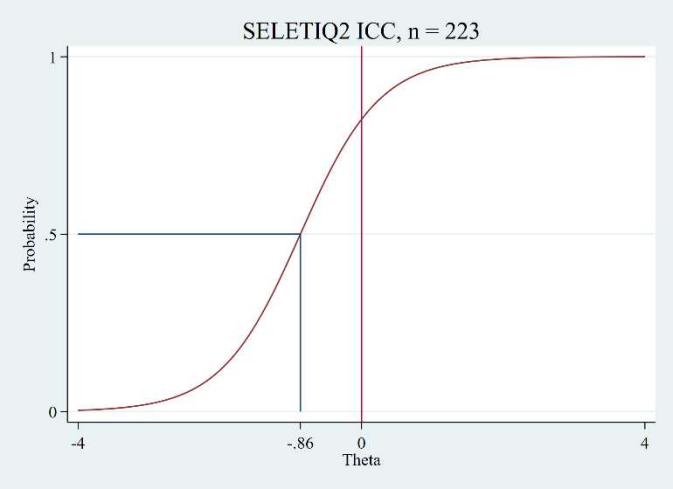

SELELEM2 IIF, n = 199
Information
2
1.5
1
.5
0
-4
-2
-1.5
0
1.5
2
4
Theta

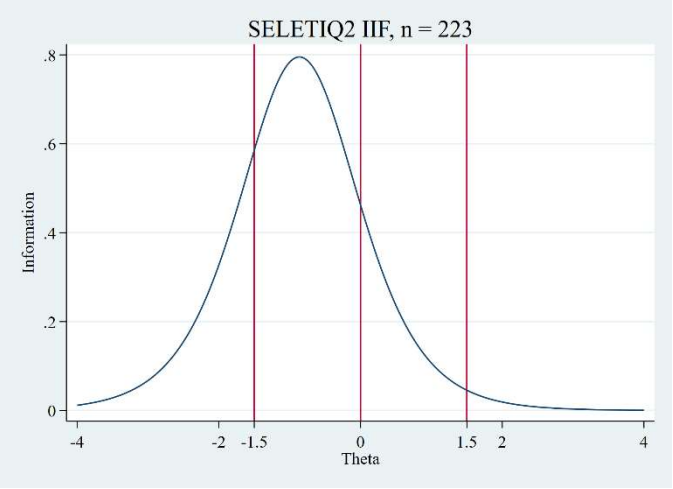

SELELEM3 ICC, n = 202
Probability
1
.5
0
-4
-.31
0
4
Theta

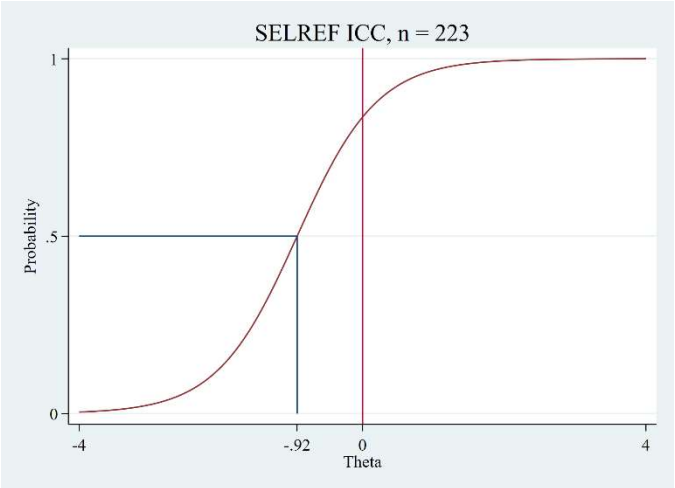

SELELEM3 IIF, n = 202
Information
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta

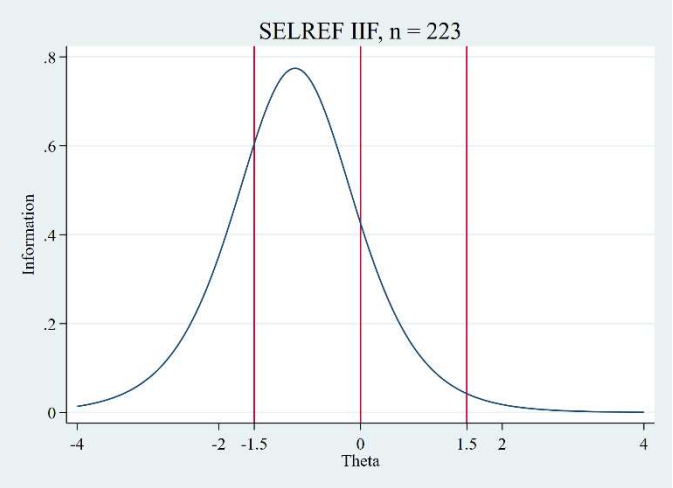

SELETIQ1 ICC, n = 230
Probability
1
.5
0
-4
-.40
0
4
Theta

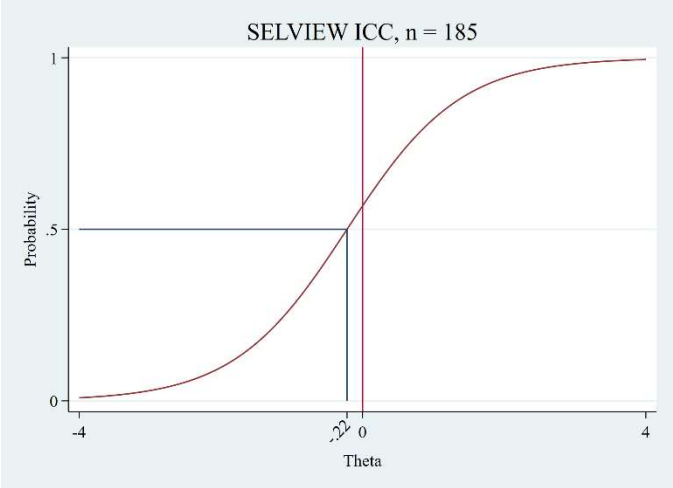

SELETIQ1 IIF, n = 230
Information
.4
.3
.2
.1
0
-4
-2
-1.5
0
1.5
2
4
Theta

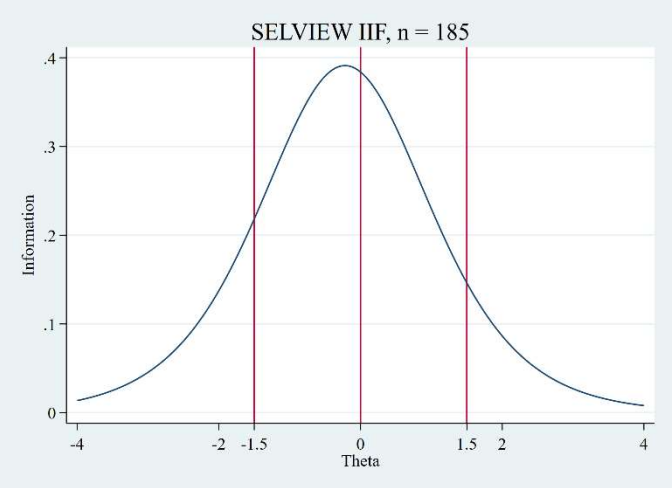

SELETIQ2 ICC, n = 223
Probability
1
.5
0
-4
-.86
0
4
Theta


SELETIQ2 IIF, n = 223
Information
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta


SELREF ICC, n = 223
Probability
1
.5
0
-4
-.92
0
4
Theta


SELREF IIF, n = 223
Information
.8
.6
.4
.2
0
-4
-2
-1.5
0
1.5
2
4
Theta


SELVIEW ICC, n = 185
Probability
1
.5
0
-4
-.22
0
4
Theta


SELVIEW IIF, n = 185
Information
.4
.3
.2
.1
0
-4
-2
-1.5
0
1.5
2
4
Theta

VITA

Kesha S. Valentine
Old Dominion University
Department of STEM Education
4101-A Education Building

EDUCATION

Bachelor of Science in Marketing (May 1994), George Mason University
Master of Business Administration (August 2000), Marymount University
Education Specialist in Business Education (July 2007), University of West Georgia

EMPLOYMENT

Fairfax County Public Schools
- Educational Specialist, Library (January 2018 – present)
- Equity Lead (July 2018 – June 2021)

Falls Church City Public Schools
- Library Media Specialist (August 2012 – December 2017)
- Extended Essay Coordinator

University of Phoenix
- Adjunct Professor, *online* (Summer 2009 – Fall 2015), General Studies

Atlanta Public Schools
- Library Media Specialist (August 2010 – May 2011)

Fulton County Public Schools
- Business Education Teacher (August 2009 – July 2010)

Atlanta Public Schools
- Business Education Teacher (August 2006 – May 2008)
- Special Education Teacher (August 2004 – May 2006)

SELECTED PUBLICATIONS AND PRESENTATIONS

Valentine, K. S., & Kosloski, M. F. (2021). Developing the Key Constructs of Career Literacy: A Delphi Study. *Journal of Research in Technical Careers, 5*(1). https://doi.org/10.9741/2578-2118.1095

Valentine, K. S. (2018). Review of improving education together: A guide to labor, management, and community collaboration. *Education Review//Reseñas Educativas*, 25.

"Career literacy: If you don't get it, you don't get it." Association of Career and Technical Education Research, national conference. November 2020. Virtual. (poster)

"The stories your book collections tell." Fairfax County Public Schools, Equity Symposium. July 2020. Virtual. (concurrent session).

ORGANIZATIONS, AWARDS, AND SERVICE

ECMC Postsecondary Career and Technical Education Research Fellow (2021)

Association for Career and Technical Education Research (ACTER)
- Conference committee *co-chair* (2022)