ABSTRACT

Title of Dissertation: INVESTIGATING INDIVIDUAL DIFFERENCES' PREDICTION OF LANGUAGE PROFICIENCY OUTCOMES: A LATENT GROWTH CURVE MODELING APPROACH

Elizabeth Rhoades, Doctor of Philosophy, 2023

Dissertation directed by: Professor, Dr. Kira Gor, School of Literatures, Languages, and Cultures

Although decades of research within the field of second language acquisition have been dedicated to investigating the impact of individual differences on second language learners' success, longitudinal research focused on individual differences and their impact on adult second language acquisition is extremely limited. Additional longitudinal research on individual differences is necessary to further our understanding of the nature of the process of adult second language acquisition. This area of research is also critical to the U.S. Government and the Department of Defense as thousands of military service members work in language-related positions, and these service members' maintenance of high levels of language proficiency is critical for our nation's national security. The current study used a longitudinal design to investigate the impact of individual differences such as general cognitive ability, language aptitude, and attitude toward learning assigned second language (L2) on military service members' language proficiency outcomes. Latent growth curve modeling (LGM) was used to model participants' initial proficiency levels and growth trajectories, and measures of cognitive ability, language aptitude, and attitude toward learning assigned L2 were used to measure the impact of these individual differences on language proficiency outcomes. Additional variables

including GPA, age, education level, number of language training hours, billet type, and sex were also included in the analyses. The results from the four phases of analyses support the conclusion that the predictive value of individual difference factors on language proficiency outcomes differ not only by DLI Language Difficulty Category, as suggested by previous research, but also by language and even language modality.

INVESTIGATING INDIVIDUAL DIFFERENCES' PREDICTION OF LANGUAGE PROFICIENCY OUTCOMES: A LATENT GROWTH CURVE MODELING APPROACH

by

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Dedication

I dedicate my dissertation work to my Lord and Savior Jesus Christ, for without Him, none of this would have been possible, and to the family that I am so incredibly blessed to be able to call my own: my husband, Eric, and our three children, Caitlin, Robert, and Peter.

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

U.S. Military Service members who enter the language profession receive intensive language training at the Defense Language Institute Foreign Language Center (DLIFLC). Upon entering the U.S. military, service members take the Armed Services Vocational Battery (ASVAB), which is summarized by the Armed Forces Qualifying Test (AFQPT), a composite score of the four ASVAB subtests. If the services members are successful on the ASVAB, they are offered the opportunity to take the Defense Language Aptitude Battery (DLAB). Service members who obtain high scores on the DLAB are encouraged to pursue positions that require foreign language proficiency. Before they can be considered language professionals, however, they must graduate from the intensive language training offered at DLIFLC. The intensive language training at DLIFLC ranges from 26 to 64 weeks, depending on the language. Students are placed into a language program based on their DLAB scores (see Table 1). DLIFLC categorizes languages into four levels of difficulty (Categories I, II, III, IV), and the categorization is based on how long it is expected to take military service members to achieve at least a level 2 in the language. According to DLIFLIC, Category I languages are the easiest to learn, and Category IV languages are the most difficult to learn. Therefore, Category I language training programs are the shortest, and Category IV language training programs are the longest.

Table 1. DLIFLC Language Difficulty Categories and Minimum DLAB Scores

LANGUAGE DIFFICULTY CATEGORY	LANGUAGES	MINIMUM DLAB SCORE
Category I	French, Spanish	95
Category II	Indonesian	100

LANGUAGE DIFFICULTY CATEGORY	LANGUAGES	MINIMUM DLAB SCORE
Category III	Dari, Hebrew, Persian-Farsi, Russian, Serbo-Croatian, Tagalog, Turkish, Urdu	105
Category IV	Arabic, Chinese, Japanese, Korean, Pushtu-Afghan	110

From DLIFLC General Catalog (DLIFLC, 2021).

Upon graduation, DLIFLC graduates take the Defense Language Proficiency Test (DLPT) in both reading and listening to determine their language proficiency levels. They continue to take the DLPT every year after they leave DLIFLC. The DLPTs are scored, and raw scores (number of correct items) are converted into Interagency Language Roundtable (ILR) ratings. Only the ILR ratings are reported to the military service members and their chain of command. The Interagency Language Roundtable (ILR) is a Federal interagency organization with members of the Federal government, academia, and industry. This organization is unfunded, and its purpose is to enable the sharing of information about federal language-related activities. The ILR scale, which was developed with the support and approval of the ILR, is a set of descriptions of language proficiency levels for different skills such as reading, listening, and speaking. The scale ranges from 0 (No proficiency) to 5 (Native or bilingual proficiency) and a plus (+) is added to a rating when an individual's proficiency rating substantially exceeds one skill level but does not fully meet the criteria for the next skill level. Level 1 is "elementary proficiency," Level 2 is "limited working proficiency," Level 3 is "general professional proficiency," Level 4 is "advanced professional proficiency" and Level 5 is "functionally native proficiency." Detailed descriptions of the ILR scale and its levels are available at govilr.org.

The testing and language training that is required for military service members to become language professionals requires a significant investment of both time and funding by the U.S. Government. In addition, many of these trained military service members end up working at the

Department of Defense (DOD) where there is a need for trained language professionals with high levels of language proficiency. For these reasons, the U.S. Government, DLIFLC, and the DOD are all interested in investigating the factors that impact service members' success at the DLIFLC and their ability to maintain or increase their language proficiency levels once they leave DLIFLC. In addition, they are interested in obtaining a clearer picture regarding how these military service members' language proficiency levels change over time.

The current study used a longitudinal design to analyze language proficiency test scores (DLPT scores). Latent growth curve modeling (LGM) was used to model participants' initial proficiency levels and growth trajectories. The current study was not only interested in investigating language proficiency change over time, but also the impact that individual difference factors such as cognitive ability, language aptitude, and attitude towards assigned second language have on language proficiency outcomes. Cognitive ability was measured through the ASVAB (AFQPT), language aptitude was measured through the DLAB, and attitude towards assigned L2 was measured through a survey that military members complete when they begin their language training at DLIFLC. The following predictor variables were entered into the models to investigate their impact on language learning outcomes (DLPT): cognitive ability (AFQPT), language aptitude (DLAB), and attitude. In addition, the analysis took into consideration additional variables which may impact language proficiency outcomes: students' GPA, education level, number of language training hours after DLI, age, billet type, and sex (see Chapter 3).

Research Questions and Hypotheses

This approach enabled the current study to investigate the following research questions:

Research Question 1: Which of the three predictor variables (general cognitive ability, language aptitude, motivation) is the best predictor of language proficiency growth over time?

Hypothesis 1: Language aptitude will be the best predictor of language proficiency growth over time.

Existing research suggests that language aptitude is likely to be a better predictor language proficiency growth than general cognitive ability (ASVAB) and language motivation. Ehrman and Oxford (1995) found a strong correlation between language aptitude and the speaking and reading proficiency of United States Department of State Employees. Lett and O'Mara (1990) found that the DLAB contributed to the prediction of foreign language reading and listening proficiency measures. In addition, the results from Silva and White (1993) showed that the DLAB consistently improved the prediction of end-of-training reading and listening proficiency beyond that of the ASVAB and general aptitude. Research in the Special Operations Forces community has also demonstrated that language aptitude is one of the strongest predictors of proficiency outcomes (SWA Consulting, 2005; 2008b; 2009b; 2012). The results from Mackey (2014) revealed that the DLAB positively impacted initial level and growth in reading proficiency. Wagener (2016) similarly found that the DLAB was a significant predictor for initial levels of reading and listening proficiency. In addition, Doughty (2019) found that the MLAT and Hi-LAB were better at predicting on-time and eventual success on a speaking and reading proficiency test than prior language learning experience.

Smaller scale studies have found the ASVAB to be a predictor of training outcomes for foreign language professionals (Lett and O'Mara, 1990; Mackey, 2014; Silva and White, 1993; Wagener, 2016). Welsh et al. (1990), in their review of 172 studies that investigated the validity of the ASVAB, found the AFQT composite to be a strong, valid predictor of job performance measures. While the ASVAB will likely predict initial language proficiency and language proficiency growth, the existing research suggests that language aptitude will be a better predictor.

The existing literature suggests that higher levels of motivation are likely to coincide with higher levels of second language proficiency. The results from Masgoret and Gardner (2013)'s meta-analysis suggest that motivation is likely to correlate with achievement measures. Although the DLPT is not an achievement measure, if motivation leads to higher levels of achievement, it is also likely to lead to higher levels of proficiency. The results from Sparks et al. (2011) support this assertion. The results from their factor analysis of a test battery revealed that the participants with higher levels of motivation performed the best on measures of L2 aptitude and the majority of the L2 proficiency measures. Therefore, attitude towards assigned language, which is related to motivation, is expected to predict initial language proficiency and language proficiency growth but not to the extent of aptitude.

Research Question 2: Does the extent to which the predictor variables (cognitive ability, language aptitude, and motivation) predict initial levels of proficiency vary by language difficulty category?

Hypothesis 2: The predictive value of cognitive ability, language aptitude, and motivation on initial proficiency levels will vary among language difficulty categories.

The very limited research in this area suggests that the extent to which the predictor variables impact initial levels of proficiency will vary among languages in separate difficulty categories. The results from Lett and O'Mara (1990) suggest that the DLAB may be more valuable in predicting success in more difficult languages and the ASVAB may be more valuable in predicting success in easier languages. The results from Winke (2013) imply that the higher language aptitude a learner has, the less a learner may need motivation. These results imply that the predictor variables' impact on proficiency levels may vary because the military students at DLIFLC are generally placed into more difficult languages if their DLAB scores are higher and easier languages if their DLAB scores are lower. Results from Wagener (2016) suggest that individual difference measures for cognitive ability and language aptitude may have a different impact on language proficiency levels among individuals assigned to languages in different language difficulty categories. In addition, Doughty (2019) found that while aptitude and prior learning success both predicted on-time and eventual success for those students studying easier (Category I) languages, only aptitude (MLAT, Hi-LAB) predicted success for students studying harder (Category III and IV) languages. These results suggest that aptitude, as measured by the DLAB, will be the best predictor for participants in the more difficult language categories (Category III and IV).

Research Question 3: Do the predictor variables (cognitive ability, language aptitude, and motivation) interact with one another?

Hypothesis 3: Language aptitude will interact with general cognitive ability and motivation.

While there have been few studies that have considered interactions between language aptitude, general cognitive ability, and motivation, the existing literature suggests they will interact. Results from Mackey (2014) revealed a significant interaction between language aptitude and general cognitive ability and results from Winke (2013) and Sparks et al. (2011) suggest that language aptitude may interact with language motivation.

Research Question 4: Is the shape of the language proficiency growth trajectories homogenous or does it differ between individuals?

Hypothesis 4: Variation between language proficiency growth trajectories between individuals in the same language difficulty category will not be significant.

Results from previous studies (Bloomfield et al, 2012; Mackey, 2014; Shearer, 2013) suggest that although there is language proficiency growth over time, it is limited and non-linear. Once the predictor variables are considered, it is not expected that there will be significant variation among individuals in the same language difficulty category.

Research Question 5: Is the shape of the language proficiency growth trajectories mediated by language difficulty category?

Hypothesis 5: Variation between language proficiency growth trajectories between individuals in different language difficulty categories will be significant.

Surface, et al. (2004) found that language difficulty negatively impacted initial language proficiency levels and limited language proficiency growth. Results from Wagener (2016) and Mackey (2014) also suggest that the growth trajectories may vary between individuals assigned to languages in different language difficulty categories.

The research questions for this project were investigated through multiple sets of analysis organized into phases outlined below. For Phase I, latent growth curve prediction models were run using converted ILR ratings (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2 + = 26) for the entire

DLPT Listening and Reading datasets without predictors. Phase I also included latent growth curve models that were run separately for the listening and reading datasets according to ILR level. Models were run using converted ILR ratings for both listening and reading for DLI Language Difficulty Category I, III, and IV languages (languages were grouped together by DLI Language Difficulty Category). The main predictors (general cognitive aptitude (COG), language aptitude (APT), and attitude towards assigned language (ATT)) were added one at a time to the base models for the DLI Language Difficulty Category I, III, and IV analyses. For the results from Phase I, see Chapter 4, and for more details regarding the methodology used, see Chapter 3.

Although Phase I uses converted ILR ratings, which is in line with previous studies and permit the comparison across languages within the same analysis, these converted scores have inherent limitations. When the ILR ratings are created, they lose the fine-grained distinctions that the raw scores (number of correct answers) provide. One unique aspect of this study is that raw scores are used for the individual language analyses, ensuring that the most fine-grained measure of participant DLPT performance is used as the outcome variable. For Phase II, latent growth prediction models were run for the DLPT Listening and Reading datasets for individual languages (Spanish, Persian, Russian, Chinese, Korean, Arabic (MSA)) using raw scores (not converted ILR ratings) with the three main predictors (COG, APT, ATT). For Phase III, latent growth prediction models were run for individual languages using raw scores with the subtests of the ASVAB (COG) and DLAB (APT) and ATT if it was significant in Phase II. For details regarding the ASVAB and DLAB subtests, see Chapter 3. For Phase IV, latent growth prediction models were run for individual languages using raw scores with the subtests that were significant in Phase III and additional predictor variables (GPA, age, educational level, number of language training hours, billet type, and sex). For additional details regarding the analyses, see Chapter 3. For the results from Phases II, III, and IV, see Chapter 5.

Organization of the Remaining Chapters

Before details of the study are introduced, Chapter 2 will introduce relevant literature on the individual differences included in this study. Chapter 3 explains the methodology used for this study. Chapter 4 outlines the results from Phase I which includes the DLPT listening and reading models that included all languages and the results from the separate ILR Category analyses (I, III and IV). Chapters 5 outlines the results from the individual language analyses: Spanish Listening and Reading, Persian Listening and Reading, Russian Listening and Reading, Chinese Listening and Reading, Korean Listening and Reading, and Arabic Listening and Reading. Chapter 6 presents a summary of the results and discussion, and Chapter 7 presents a conclusion and suggestions for further research.

Chapter 2: Literature Review

Individual Differences

Individual differences (IDs) refer to enduring personal characteristics that distinguish one person from another. In the field of second language acquisition, research on individual differences provides insight into why some adults learn a second language (L2) more rapidly or to a higher degree of proficiency than others. Decades of research in the field of second language acquisition have been dedicated to studying if individual difference factors, such as age of acquisition, cognitive ability, motivation, and aptitude, contribute to the degree of second language learners' success.

Age of acquisition is an individual difference factor that is frequently included in second language acquisition studies. A significant amount of research has been dedicated to investigating the impact of the age of language learners on their success in learning a second language. The term 'critical period' was first used by Lenneberg (1967) to refer to the period during which language acquisition should take place for the language learner to be the most successful; he suggested this was between the age of two and puberty. Lenneberg did not imply that adults could not learn another language, but that "the automatic acquisition from mere exposure to a given language seems to disappear after this age, and foreign languages have to be taught and learned through a conscious and labored effort" (p. 176). Although it is generally accepted children make better language learners than adults, it is important to consider why they are better at language learning, the conditions that help them to be the best language learners, and what aspects of language they are better at learning (DeKeyser, 2000). Some of the distinctions that need to be made when discussing age-dependent success in second language learning are between ultimate attainment and speed of language learning, explicit and implicit learning, and the different aspects of language that are impacted (DeKeyser, 2000). It is also important to consider the contexts in which the language learners are learning the second language. Are the language learners immigrants in a new country or are the language learners in a foreign language classroom? “While age of learning may often be the strongest predictor of ultimate attainment in immigrant contexts, when it comes to foreign language learning, the quality of age-adapted teaching and individual differences in aptitude and motivation are much more important than just starting early” (DeKeyser, 2019, p. 240). The data for the current study only includes data from adults, ages 18 and older, so age of acquisition is not an area of focus. However, the data will include the age of the participants and their education backgrounds (high school degree or college degree) when they started the intense language instruction at DLIFLC because age and the life experiences that come with age and education may impact language proficiency growth over time.

In addition to age, three additional individual difference factors that may explain differences in rate of acquisition or ultimate attainment are motivation, cognitive ability, and language aptitude. Motivation refers to the L2 learner’s desire to become a member of the community of L2 speakers, good attitude about learning the L2, and eagerness to communicate in the target language. In this study, the focus will be on a subcomponent of motivation: attitude toward learning a second language. Cognitive ability, sometimes referred to as general intelligence (*g*), refers to an individuals’ ability to use mental processes such as reasoning, solving problems, and acquiring new knowledge. Language aptitude refers to a set of cognitive and perceptual abilities assumed to help L2 learners acquire a target language. This review will examine the literature on these IDs as factors contributing to success in the L2.

Attitude Toward Learning Assigned Second Language

Within the field of education, motivation is understood to play an important role in learning, and it is particularly important in the process of L2 learning. It has even been proposed as being second only to aptitude as the strongest predictor of success in learning a second language (Skehan, 1989). The focus of this study is on a subcomponent of L2 motivation: attitude toward learning a second language. The data for this study is from military service members who attended the DLIFLC; these military service members are assigned a language to study. Therefore, this study is focused on the impact of attitude toward an *assigned* language on language proficiency change. The research in this area is scarce; therefore, this review will examine the limited research that exists and then provide an overview of the broader L2 motivation literature.

Carroll (1958) conducted a factor analysis of two language aptitude batteries with data from 168 Air Force enlisted cadets who were required to attend an intensive three-to-five-day Mandarin Chinese course. The 'linguistic interest' factor described as an 'increment of test performance ascribable to a specific motivation, interest, or facility with respect to linguistic materials' was found to be an important component of language aptitude (p.18). The study concluded that this factor, an indication of attitude towards foreign language learning, plays an important role in foreign language learning.

Johnson (1984) investigated which factors impact foreign language learning outcomes, specifically DLPT reading and listening and final course grades. One hundred and three DLIFLC students completed an attitude motivational inventory that contained items measuring the students' attitude toward foreign language learning and attitude toward the specific language being studied. Student attitude toward foreign language learning, student attitude toward the specific language being studied, and total student attitude toward foreign language learning (total of the other two attitudinal variables) were all strong predictors of DLPT reading scores, DLPT listening scores, and final grades. These results imply that there is a positive association between attitudes toward the specific foreign language studied and DLPT reading and listening scores and final grades.

Kim (1995) also conducted a study with DLIFLC students; the 80 DLIFLC students included in the study were studying Korean. An adapted version of the Attitudes/Motivation Test Battery (Gardner, 1985b) was used to measure attitudes/motivation towards learning Korean. Although overall motivation levels of the students decreased over the duration of the students' time at DLIFLC, 'interest in foreign language', 'attitude towards learning Korean', and 'desire to learn Korean' were found to be positively correlated with DLPT listening, DLPT reading, and oral proficiency exam scores. This study concluded that the students who had a greater interest in learning their assigned language achieved the highest levels of achievement.

The limited research that exists suggests that there is a positive relationship between attitude toward learning an assigned language and language outcomes. This study is focused on one specific aspect of L2 motivation; nevertheless, it is helpful to consider how attitudes toward learning assigned languages fits within the broader concept of L2 motivation.

Robert Gardner and associates initiated the first research on language learning motivation and continued to pursue research on L2 motivation (Gardner and Lambert, 1959, 1972; Gardner and Maclntyre, 1991, 1993; Tremblay and Gardner, 1995; Gardner, Tremblay, and Masgoret, 1997). L2 motivation was originally defined by Gardner and Lambert (1959) as the "effort and enthusiasm students show in their attempt to acquire the language" (p.267). L2 motivation is considered a factor that may explain why some language learners are more successful than others. Within Gardner's Socio-educational Model of Second Language Acquisition "integrative motivation" consists of three components (Gardner, 1985a, 2000). The component that is most closely associated with the measure of attitude included in this study is motivation, which refers to "the level of effort invested in learning the language and attitude toward the learning process itself" (Masgoret & Gardner, 2003, p.127). Motivation is understood to be responsible for an individual's success in learning a second language (Gardner & Smythe, 1975).

The research by Gardner, and others who follow this model, frequently use the Attitude/Motivation Test Battery (AMTB) to measure the components of the model. The AMTB has 11 subtests; 9 of the tests assess the attitudinal and motivational variables associated with second language learning: attitudes toward the target language group, interest in foreign languages, integrative orientation, motivational intensity, attitudes toward learning the target language, desire to learn the target language, instrumental orientation, and integrative orientation (Gardner, 1985b). Masgoret and Gardner (2013) conducted a meta-analysis of studies conducted by Gardner and associates. The meta-analysis reviewed the correlations between attitude, motivation, and orientation measures and second language achievement measures. The data was taken from 75 independent samples involving 10,489 participants. The mean corrected correlations between the variables and course grades were 0.24 (attitudes toward the learning situation), 0.37 (motivation), 0.24 (integrativeness), 0.20 (integrative orientation; assessment based on motivation that involves interaction with the language community), and 0.16 (instrumental orientation; assessment of one's pragmatic reasons for language study). The mean corrected correlations between the variables and participants' self-rating achievement scores were similar, with motivation having the highest correlation at 0.39. The results from this study suggest that motivation is most likely to correlate with achievement measures (with a medium effect size) followed by integrativeness, attitudes toward the learning situation, and integrative orientation (with intermediate effect sizes), and instrumental orientation (with a small effect size).

Since Gardner and Lambert (1959) initiated the first research regarding motivation in L2 learning, L2 motivation and its conceptualization has evolved. However, even though researchers have conceptualized motivation in different ways, they agree that high levels of motivation are important for L2 learners to be successful. In addition, high levels of motivation may make up for lower cognitive abilities (Dörnyei, 1990; Pimsleur, 1966; Schmidt, 1991; Sternberg, 2002) and may even be necessary for those with high levels of cognitive abilities, such as aptitude, to be successful in L2 language learning (Doughty, 2019). This implies that the effects of cognitive abilities, such as aptitude and intelligence, may be impacted by motivation. The research in this area is limited; however, Winke (2013) conducted a study that included both cognitive variables and an L2 motivation measure and with data from students at DLI; the data for the current study will also be from DLI students. In Winke (2013) 96 adult native English speakers studying advanced Chinese at the Defense Language Institute (DLI) took the Modern Language Aptitude Test (to measure L2 aptitude), a phonological working memory test, and completed motivation and strategy use questionnaires. L2 learning was measured using DLPT reading, listening, and speaking scores. Structural equation modeling was used to investigate the influence of L2 aptitude on learning Chinese at an advanced level. Although the results were not statistically significant, the data showed that L2 aptitude negatively affected motivation (r = -.27, p = .58), and motivation had more of an effect on reading (r = .16, p = .17) than listening or speaking. Winke (2013) notes that the "significance testing should not be overemphasized" with these results because strategy use was correlated with motivation (r = .40, p = .00), thus implying that the significance of the independent effects of these variables was reduced (p.119). These results imply that perhaps the higher L2 aptitude a learner has, the less the learner needs motivation (Dornyei, 2005).

The current literature suggests that L2 motivation positively impacts L2 proficiency and that there may be a relationship between L2 motivation and L2 aptitude; however more research in this area is needed, and longitudinal data provides a clearer picture as to how a component L2 motivation, attitude toward learning an assigned language, impacts L2 proficiency over time. Attitude toward learning an assigned language in the current study was operationalized using the results to a single Likert-scale item. Military service members, upon arrival to DLI, are asked what their level of motivation is for studying the language they were assigned to. Their choices are: 1- Not my choice. I would prefer to do something else rather than study a foreign language; 2- Not my choice. I am not motivated to study the assigned language; 3- Not my choice, but I am still motivated to study the assigned language; 4- Based on my second or third choice; 5- Based on my first choice. The current study analyzed longitudinal data and included a measure of attitude and other factors that may impact language proficiency outcomes and change over time, including cognitive ability (ASVAB) and L2 aptitude (DLAB). This study therefore not only provides an enhanced understanding of the impact of attitude on language proficiency outcomes, but also how it how it interacts with cognitive factors such as general cognitive ability and L2 aptitude.

General Cognitive Ability: The Armed Services Vocational Aptitude Battery (ASVAB)

The ASVAB is developed and maintained by the Department of Defense, and it is used to determine eligibility for the U.S. Military. Four of the scores taken from the ASVAB (arithmetic reasoning (AR), word knowledge (WK), paragraph comprehension (PC), and mathematics knowledge (MK)) make up the AFQT, which is used to determine whether or not a recruit is qualified to enlist in the U.S. Military. The scores in the other parts of the ASVAB determine how qualified recruits are for specific occupations. The ASVAB is composed of ten subtests (Table 2). The services (Airforce, Army, Navy, Marines) all use different minimum scores to determine if recruits are qualified for an occupation in foreign language. The recruits must also receive a minimum score on Defense Language Aptitude Battery (DLAB) to qualify for an occupation in foreign language. While the services do differ in terms of which subtests make up their minimum required scores, they are all interested in the verbal subtests (WK and PC) and at least one of the math subtests (AR and MK) (Schmitz et al., 2009).

Table 2. ASVAB Tests and the Constructs Measured

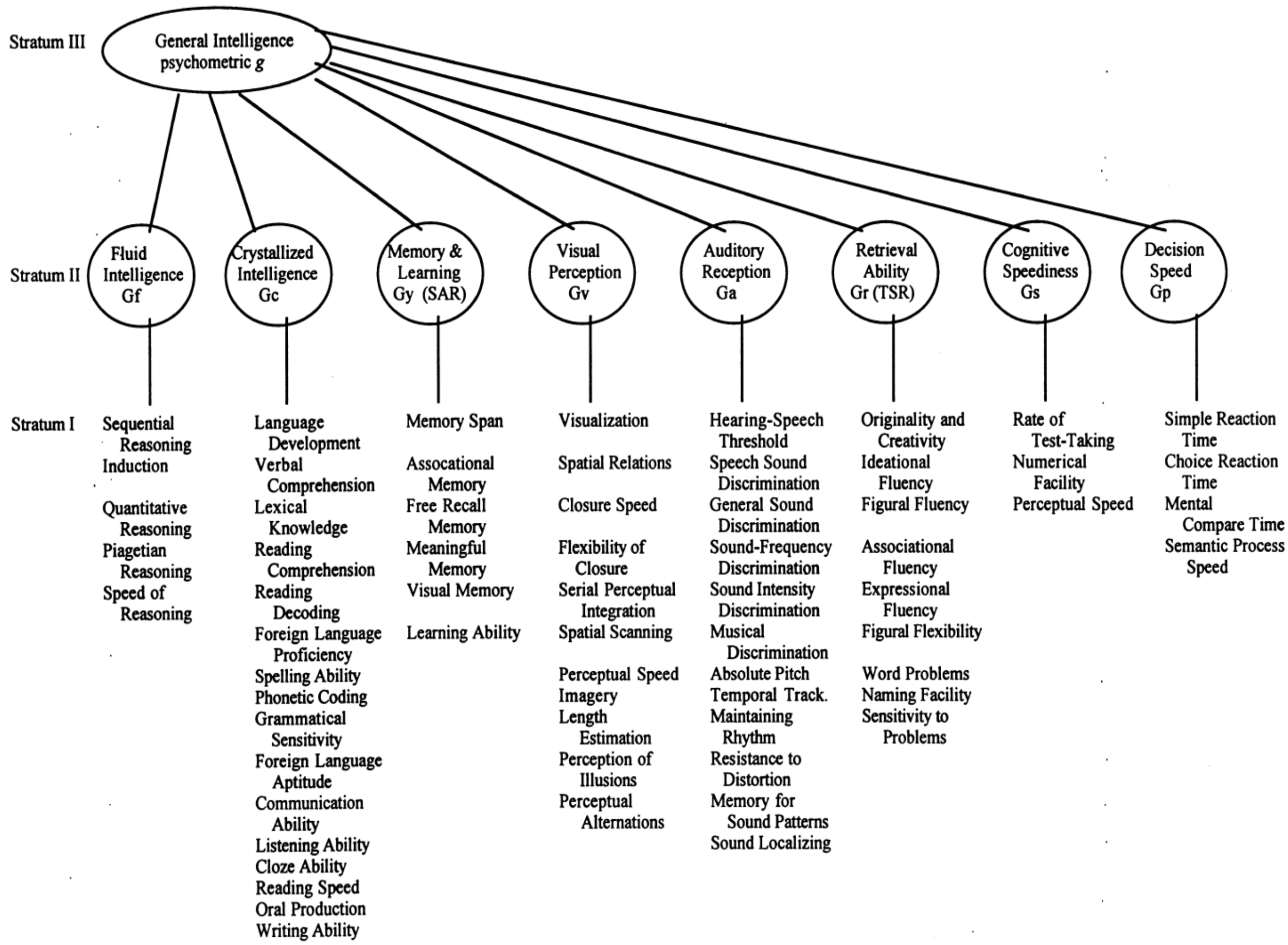
TEST	CONSTRUCT
Verbal	
Word Knowledge (WK)	*Ability to select the correct meaning of words presented in context and to identify best synonym for a given word.*
Paragraph Comprehension (PC)	*Ability to obtain information from written passages.*
Mathematics	
Arithmetic Reasoning (AR)	*Ability to solve arithmetic word problems.*
Mathematics Knowledge (MK)	*Knowledge of high school mathematics principles.*
Science/Technical	
General Science (GS)	*Knowledge of physical and biological sciences.*
Electronics Information (EI)	*Knowledge of electricity and electronics.*
Auto Information (AI)	*Knowledge of automobile terminology and technologies.*
Shop Information (SI)	*Knowledge of tools and shop terminology and practices.*
Mechanical Comprehension (MC)	*Knowledge of mechanical and physical principles.*
Assembling Objects (AO)	*Ability to figure out how an object will look when its parts are put together.*

The developers of the ASVAB were primarily concerned with its ability to be used as a test to determine where recruits would be assigned, so the subtests were "selected on the basis of perceived similarities to military occupations rather than any psychological theory." (Roberts, et al., 2000, p. 87). Nevertheless, it's important to understand where the ASVAB's subtests fit within the theories of general intelligence. Fluid intelligence (Gf) is "most closely related to biological influences operating in development" and "crystallized intelligence" (Gc) "more directly reflects cohesiveness and individual differences in a broad set of experiential learning influences" (Horn & Cattell, 1967, p. 211). One clear difference between the two types of intelligences is the impact that formal education has on them. It is "well established that fluid intelligence (Gf) depends to a much smaller extent on formal education experiences than does crystallized intelligence" (Roberts, et al, 2000; p. 84). The three-stratum model proposed by Carroll (1993) was influenced by both Spearman's (1927) model of general intelligence and Horn & Cattell's (1966) theory of fluid and crystallized intelligence.

Carroll's three strata, or layers, represent narrow, broad, and general cognitive ability. General cognitive ability (GCA), at the top of the hierarchy at stratum III, causes the development of aptitudes at the next level. The next stratum, stratum II, includes fluid intelligence (Gf), crystallized intelligence (Gc), general memory and learning (Gy), broad visual perception (Gv), broad auditory perception (Gu), broad retrieval ability (Gr), broad cognitive speediness (Gs), and processing speed (Gt). These aptitudes then cause the development of specific cognitive skills at the stratum I level. Figure 1 is an illustration of Carroll's three stratum model.

Figure 1

Three-stratum Model of the Structure of Human Cognitive Abilities

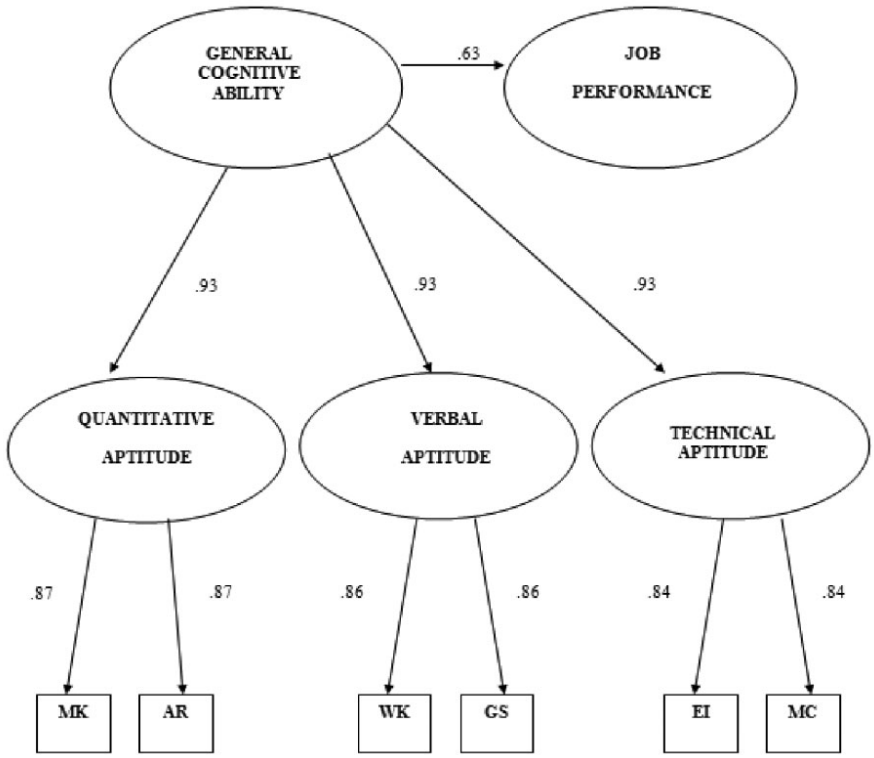


From Carroll (1993, p. 626).

Figure 2 is based on data from Hunter et al. (1985) (reproduced in Schmidt, 2012), developed from U.S. Army data on over 16,000 military service members. It illustrates the finding that GCA predicts job performance and not the stratum II aptitudes or the stratum I specific cognitive skills. However, this figure also “illustrates why any measure that combines measures of three or more specific aptitudes is, in effect, a measure of GCA” (Schmidt, 2012, p. 4).

Figure 2

Model illustrating a hierarchy of ASVAB mental abilities



Note. The hierarchy of mental abilities as found in the Armed Services Vocational Battery. From Hunter et al. (1985, p.C61): MK, math knowledge; AR, arithmetic reasoning; WK, word knowledge; GS, general science knowledge; EI, electronics information; and MC, mechanical comprehension.

GCA is measured by its causal effects, and if GCA causes the stratum I skills through the stratum II aptitudes, then a combination of reliable tests of stratum I skills could be considered a measure of GCA because this combination will be almost perfectly correlated with GCA. GCA is not "measured directly…but measured through its effects or products" (Schmidt, 2012, p.4). Therefore, for the ASVAB, the measures that make the up the AFQT (AR, WK, PC, and MK) could be considered together as a measure of general cognitive ability. However, research on the ASVAB has shown that "although it was intended to measure aptitude, that is, the propensity to do well *(i.e. the ability to acquire new knowledge*)… the ASVAB primarily reflects acculturated or acquired knowledge, or crystallized intelligence." (Martin et.al, 2020, p. 2)

Roberts et al. (2000) conducted two studies using data from US Air Force recruits. The participants completed the ASVAB and other tests thought to reflect Gc, Gf, an individual's ability to perform novel tasks, and general speed. Their exploratory and confirmatory factor analysis of the data suggested that the ASVAB primarily measures crystallized intelligence (Gc). Five of the eight ASVAB subtests in the dataset loaded substantially onto Gc and only three loaded onto a factor under Gr reflecting technical knowledge. (This factor correlated with Gc.) In addition, three of the eight subtests loaded onto a Gf factor, but they shared variance with either the Gc or technical knowledge factor. Therefore, none of the subtests uniquely measured Gf. The results from their second study indicated that "fluid and crystallized intelligence are structurally independent, and perhaps more importantly that the ASVAB under-represents several broad factors considered crucial in extant models of human cognitive ability." (Roberts et al., 2000, p. 96).

While the ability of the ASVAB to provide a measure of general cognitive ability beyond Gc is debated, numerous studies have shown that ASVAB is valid as a predictor of success in military training schools, first-term attrition, and job performance (Welsh, et al., 1990). Welsh et al. (1990) conducted a review of 172 studies that investigated the content validity, construct validity, and criterion-related validity of the ASVAB. The results from their extensive review showed that the AFQT composite is a valid predictor of enlisted, entry-level final technical school grades, self-paced technical completion times, first-term attrition, and job performance measures. The AFQT was consistently found to be a strong valid predictor of technical school grades with the coefficient ranging between 0.55 and 0.60. (Welsh, et al, 1990). The magnitude of the coefficients did not appear to differ by military service. Welsh et al. conclude that the ASVAB "clearly demonstrated validity" for the purpose of appropriately selecting and classifying the most trainable military applicants (Welsh, et al, 1990, p. 108). Important for the current study, however, is the fact that there were no studies in this review that investigated the predictive validity of the AFQT for the job performance of military foreign language professionals.

Additional large-scale studies have found that general cognitive ability and specific cognitive ability measures predict training success and job performance (Bertua et al, 2005). In their UK meta-analysis, Bertua et al. found that all general mental ability (GMA) and cognitive ability tests were valid predictors of job performance and training success with the operational validities for job performance ranging from .50 to .35 and the operational validities for training success ranging from .54 to .42. Previous research has also found higher operational validities for training success than job performance (Bertua et al., 2005; Pearlman et al., 1980). Their UK analysis also found that GMA tests were valid as predictors across different occupational groups with operational validities ranging from .74 for professional occupations to .32 for clerical occupations. Just as in previous analyses, no studies in this meta-analysis investigated the operational validity of the GMA or cognitive ability tests for the job performance or training success of foreign language professionals. Smaller studies have found the ASVAB to be a predictor of training outcomes for foreign language professionals (Lett and O'Mara, 1990; Mackey, 2014; Silva and White, 1993; Wagener, 2016); however, further research is needed. These smaller-scale studies included another individual differences measure that will also be included in the current study that should be considered in relation to general cognitive ability: language aptitude. The current study addresses these gaps in the existing literature.

Language Aptitude

Unlike other individual difference variables in SLA, like motivation, language aptitude is considered a fairly stable and enduring trait. Aptitude has been conceptualized in a variety of ways in SLA research; however, it is generally considered a set of cognitive abilities that help L2 learners acquire a second language. The most influential aptitude model is Carroll's (1962) four-factor model that proposes four fundamental abilities for language learning: phonetic coding ability (ability to codify, assimilate and recall phonetic material), rote memory (ability to recall words in an unfamiliar language), grammatical sensitivity (ability to identify the grammatical functions of words or phrases in sentences), and inductive language ability (ability to figure out the rules of systematically varying language materials). According to Carroll (1981), language aptitude, which is a combination of these four abilities, is distinct from other individual differences such as motivation, not influenced by external factors, and predictive of how fast an L2 can be learned. In this conceptualization, language aptitude is not influenced by prior L2 learning experience and is not intended to predict ultimate L2 success; it is intended to predict how easy and how quickly an L2 can be learned during a certain period, a cognitive skillset that is certainly of interest to program administrators who oversee large scale language training at the DLIFLC.

The Modern Language Aptitude Test Battery (MLAT; Carroll & Sapon, 1959) was developed based on Carroll's view of language aptitude although only three out of the four factors are included in the battery (phonetic coding, grammatical sensitivity, and rote memory). The MLAT has been shown to be a good predictor of L2 learner's test performance and grades (Carroll & Sapon, 2002); however, it was designed to predict L2 learning in intensive language courses that do not use communicative approaches to teaching (Carroll, 1962; Robinson, 2007).

Additional aptitude tests were created and are used for specific purposes. For example, the DLAB (Petersen & Al-Haik, 1976) was developed for the Defense Language Institute (DLI) and is used to select potential language professionals for future military service. The DLAB has four sections: a biographical questionnaire that includes questions about previous language learning experience and academic background; a test taken from HABLA, Horne's Assessment of Basic Linguistic Abilities, which requires the examinee to form language concepts from pictures using an artificial language; a test taken from the Al-Haik Foreign Language Auditory Aptitude Test (AFLAAT) that measures perception of speech patterns; and a test the requires the examinee to apply grammar rules in an artificial language. The LLAMA tests (Meara, 2005) are based on the MLAT, but they can be used with speakers of any first language (L1) with a Roman alphabet, opposed to the MLAT, which was developed for L1 English speakers. In addition, the LLAMA includes a test (LLAMA D) that measures the ability to recognize patterns in spoken language.

Much of the literature on language aptitude, especially the early literature, focused on the relationship between language aptitude and ultimate attainment. The studies used to validate the MLAT found correlations (between 0.4 and 0.6) between aptitude and course or exam grades (Carroll, 1966). Ehrman and Oxford (1995) also found a strong correlation (0.51) between language aptitude, as measured by the MLAT, and the speaking and reading proficiency of U.S. Department of State employees. Other studies found aptitude is related to performance on L2 measures for high school foreign language students (Harley & Hart, 1997; Sparks, et al., 1995). Harley and Hart (1997) found that aptitude (measured by subtests of the MLAT and PLAB-IV) played a role in L2 performance for both less advanced students, who had started learning French in Grade 7, and more advanced high-school immersion students, who had started learning French in Grade 1.

Additional research has gone beyond looking at the relationship between aptitude and ultimate attainment by investigating the impact of aptitude on grammar acquisition under different learning conditions. These studies fit within an interactionist paradigm and treat language aptitude as a construct that may vary in its degree of impact depending on the learning condition. De Graaff (1997) found that aptitude, as measured by subtests of the MLAT, had the same impact on performance for undergraduate students exposed to explicit and implicit instruction during a computer-controlled self-study course in an artificial language. Robinson (1997) investigated the impact of aptitude, as measured by the rote memory and grammatical sensitivity MLAT subtests, on different learning conditions (implicit, incidental, rule-search, and instructed) for English as a Second Language students. Both rote memory and grammatical sensitivity yielded significant correlations with learning outcomes in the rule-search and instructed conditions, and grammatical sensitivity was related to learning outcomes in the incidental (focus on form) learning condition; however, aptitude was not found to be related to learning in the incidental meaning-focused condition. These results were replicated in Robinson (2002) who proposed that the low correlation between aptitude and learning in the incidental learning condition was because the learning condition was not truly implicit, and the students had found the underlying grammatical rules.

Existing research is not conclusive regarding the impact of L2 aptitude on different levels of proficiency. Although the majority of the research on L2 aptitude has been done with subtests of the MLAT, there has been some research conducted with the DLAB, the aptitude test used in the current study. The DLAB was developed to serve as a selection measure with maximized predictive validity and is used to determine which military personnel will be sent to training at the Defense Language Institute (DLI). There are many languages taught at DLI, and training at DLI is intense, so the military needed a valid aptitude measure to predict language learning success in this specific learning environment (Peterson & Al-Haik, 1976). Peterson & Al-Haik (1976) found correlations of 0.315 for the third factor (the section that requires the examinees to apply grammar rules in an artificial language) and average course grades and 0.431 for the total DLAB score and average course grades. Because military personnel must obtain a high score on the DLAB to qualify to go to DLI, there are relatively few DLI students with DLAB scores less than 100; therefore, the range of scores in this study were restricted, so the true correlations are likely higher than those reported.

Another project using the DLAB as an aptitude measure, which was meant to be the first longitudinal study of language skill change, referred to as the Language Skill Change Project, did not fulfill its original purpose to test almost 2,000 DLI U.S. Army graduates up to seven times over a period of time; however, results from a preliminary analysis are reported in Lett and O'Mara (1990). The predictor variables included cognitive ability (using the General Technical composite score from the Armed Services Vocational Aptitude Battery (ASVAB)), language ability (DLAB), demographic information (gender, level of education, age), handedness, prior language experience, attitude and motivation, learning strategies, personality and cognitive style, and other ability measures. The criterion measures included the DLI students' DLPT III (a previous version of the DLPT) scores, separately measuring their ILR Skill Levels in listening, reading, and speaking. Lett and O'Mara (1990) reported results from an analysis of Korean, Russian, German, and Spanish test scores to determine how well the variables selected for the larger study predicted success and attrition at DLI. The results revealed that even though military members go through a rigorous selection process before being approved to go to DLI, there are identifiable differences between those who succeed at DLI and those who do not. Through the use of multiple regression, Lett and O'Mara (1990) found that the variables predicted DLI foreign language proficiency outcomes and attrition, accounting for 27.7% of the variance. Attrition (at 21.3% variance accounted for) was not as predictable as the foreign language proficiency measures (at 29.8%). However, as the authors point out, this could be due to the dichotomous nature of the attrition variable. For the foreign language proficiency measures, speaking was not as predictable as listening and reading. The DLAB, ASVAB, and other abilities contributed most to the prediction of listening and reading with the DLAB appearing to be more valuable in predicting success in the more difficult languages (Russian and Korean) and the ASVAB appearing to be more valuable in predicting success in the easier languages (Spanish and German). In addition, the results showed that non-cognitive measures have the potential to predict success in foreign language proficiency attainment; specifically, the majority of the non-cognitive variables made significant contributions to the prediction of listening and reading skills and motivation appeared to be valuable in predicting speaking skills.

Masters (2018) used a contrastive- analytic approach to examine the consistency of the contribution of cognitive (general aptitude (AFQT), language aptitude (DLAB), average coursework outcomes) and non-cognitive (language preference self-assessment scores; the same Likert scale item used in the current study) variables to the development of foreign language achievement (course outcomes) and proficiency outcomes (DLPT, Oral Proficiency Interview). The analysis was conducted with three languages (Chinese, Korean, Arabic), which are all classified as belonging to DLI Language Difficulty Category IV. The analysis was conducted with two datasets: one with only DLI graduates (observed dataset) and one that included DLI graduates and others who did not complete their DLI language training (imputed dataset). (For the second dataset, missing coursework and proficiency test score data was imputed.) The results revealed that the DLAB was a consistent predictor of coursework outcomes for all languages (Chinese, Korean, Arabic) and skills (listening, reading, speaking) for both datasets and a significant predictor of DLPT Listening scores for the Arabic and Korean imputed datasets but not the observed datasets. For Chinese and Korean, the AFQT and language preference self-assessment were not significant predictors of any coursework outcomes. However, for Chinese, the AFQT was a significant predictor of DLPT Reading scores for both datasets. For Arabic, the results varied between datasets and course level outcomes; the AFQT was a significant negative predictor of two levels of course outcomes for the imputed dataset but not the observed dataset, and the language preference self-assessment was a significant negative predictor of the lowest level course outcomes for the observed dataset but a significant positive predictor of the lowest level course outcomes for the imputed dataset. For Chinese, Korean, and Arabic, the course outcomes for the highest-level courses were significant predictors of DLPT Reading and Listening scores. These results overall implied consistency in the DLAB's prediction of coursework outcomes and coursework outcomes' prediction of DLPT outcomes across three DLI Language Difficulty Category IV languages. However, the AFQT and language self-assessment results were not as consistent across languages or datasets.

Silva and White (1993) examined the incremental validity of the DLAB beyond that of general aptitude (*g*) and the ASVAB. The outcomes were foreign language reading and listening proficiency (as measured by the DLPT), speaking proficiency (measured by the Oral Proficiency Interview), and academic attrition. The results from 5,673 students showed that the DLAB consistently improved the prediction of both end-of-training reading, listening, and speaking proficiency and academic attrition. The gain in the multiple correlation coefficients ranged from .01 to .13 beyond those with only *g* and the ASVAB scores. Silva and White (1993) suggest that the results support a differential aptitude theory and that the DLAB measures a specific aptitude linked to outcomes in learning a new language that is clearly distinct from *g* and also from the abilities measured by the ASVAB. Given the significantly large number of students that go through the selection process for DLI, even the seemingly small gains in correlation coefficients are important.

Studies conducted within the Special Operations Forces (SOF) community have also demonstrated that the DLAB is a significant and consistent predictor of language proficiency outcomes (SWA Consulting, 2005; 2007; 2008a; 2009b; 2011) such as the DLPT listening and reading scores and the Oral Proficiency Interview (OPI) speaking and listening scores. This research has also shown that the DLAB, when compared with other cognitive predictors, has been one of the strongest single cognitive predictors of proficiency outcomes (SWA Consulting, 2005; 2008b; 2009b; 2012.) Despite this, the level of prediction was still not very high. For example, in SWA Consulting (2008b), the DLAB explained less than 4% of variability in post-training OPI outcomes.

Additional research has been conducted with the DLAB to investigate language proficiency growth over time. Surface, Dierdorff, and Donnelly (2004) used five sets of DLPT reading and listening scores over time from 880 U.S. Special Operations language professionals to study second language proficiency change. The predictor variables included level of education, cognitive ability (AFQT score), and language difficulty (as categorized by the DLI). The results showed that the average change in reading proficiency followed a positive linear pattern, but the average change for listening proficiency followed a linear pattern with a downward curvature. This result supported Surface et. al (2004)'s hypothesis that the growth patterns would be different for the different modalities. The results also showed that language difficulty negatively impacted initial proficiency levels and limited language proficiency growth. Education level and cognitive ability were only found to predict initial proficiency level and not growth.

Both Skehan (2002) and Robinson (2002) have proposed models of language aptitude that suggest that the aptitudes needed for the different stages of L2 learning may differ. Robinson's (2002) characterizes aptitude as being a set of lower-level abilities (e.g., pattern recognition) that can be then grouped into cognitive factors (e.g., noticing the gap) that have different effects on learning depending on the learning conditions. Skehan (2001) proposed four processing stages (noticing and registering input, patterning, controlling analyzed knowledge, and lexicalizing) and then associated them with different cognitive abilities. Although these models have yet to be developed into test batteries; research with existing test batteries provide insight into the impact of language aptitude at different stages of L2 proficiency. Harley and Hart (1997) found that aptitude played a role in L2 performance for both less advanced and more advanced high-school immersion students. In contrast, Winke (2005) found that, for native English speakers learning Chinese at an American university or the Defense Language Institute (DLI), components of aptitude (measured by the MLAT) were associated with learning at beginning levels, but not at advanced levels. Hummel (2009) also found that neither phonological memory (PM) (measured using an Arabic-based NWR task) nor language aptitude (measured using the Test d'Aptitude aux Langues Vivantes, the French version of the MLAT) were predictive of the higher proficiency English language learners and only found PM to be a reliable predictor variable for the lower proficiency group.

The need for L2 learners with high levels of language proficiency has further motivated the interest in aptitude and its ability to predict success at different stages of proficiency, particularly the most advanced levels of proficiency. The High-Level Aptitude Battery (Hi-LAB) (Linck et al., 2013) was designed to predict high-level attainment in an L2 and under the assumption that different aptitudes are needed to predict ultimate attainment rather than initial acquisition. Unlike other aptitude tests, the Hi-LAB includes measures of executive function. It contains eleven tests grouped into six categories: working memory, associative memory, long-term memory retrieval, implicit learning, processing speed, and auditory perceptual acuity. The Hi-Lab was developed due to the need to predict high-level proficiency under a variety of learning conditions; early aptitude tests, such as the MLAT, were developed to predict initial L2 attainment, measured by course or exam grades, in intensive instructed conditions.

Li (2015) conducted a meta-analysis investigating the relationship between aptitude and L2 grammar acquisition that included 17 studies examining the correlations between aptitude and ultimate L2 attainment and 16 interactional studies examining the impact of aptitude on L2 grammar acquisition in different learning conditions. Aptitude was found to have a moderate association ($r = 0.31$) with L2 grammar acquisition and aptitude was more strongly correlated with explicit learning conditions than implicit learning conditions. In addition, the role of aptitude was more evident for younger learners (high school students) in predictive studies but more evident for older learners (university students) in interactional studies.

Li (2016) conducted a meta-analysis with 66 studies that investigated the construct validity of aptitude and found a strong effect size (0.49) between aptitude, mostly measured by the MLAT, and general L2 proficiency (as measured by course grades or scores on general proficiency tests). However, the effect size attenuated to a moderate effect when specific aspects of L2 learning such as L2 grammar learning, vocabulary, and L2 writing were taken into account. Li (2016) also found that aptitude was more strongly correlated with high school learner's L2 general proficiency than university students' L2 general proficiency. The finding that the role of aptitude was more evident for younger learners (high school students) than older learners (university students) may be because there was less variation in the levels of aptitude of the university students compared to the high school students. It also could be because traditional aptitude measures, like the MLAT, are meant to predict the rate of learning a language 'from scratch' (Carroll, 1990, p. 24). In fact, Carroll (1990) recognizes the need for research on abilities that are relevant at more advanced stages of language learning. Robinson (2005) suggests that traditional aptitude measures may only be predictive of beginning stages of SLA and not later, higher levels of attainment, and that there may be different combinations of abilities that predict L2 learning success at different stages of learning. For this reason, longitudinal research investigating the predictive validity of language aptitude at different stages of language proficiency is needed.

Mackey (2014) used latent growth curve modeling (LGM) to investigate how aptitude related to language proficiency outcomes over time using ASVAB, a measure of general cognitive ability, and DLAB as the predictors with DLI graduates. The results revealed that the ASVAB showed a positive influence on initial DLPT levels in reading and listening (the DLPTs that DLI graduates take upon graduation). However, the influence of the DLAB differed between modalities. The DLAB was not significantly related to initial level of proficiency and only marginally significantly related to growth in listening; however, the DLAB did positively impact the initial level and growth in reading. Although this study did investigate the impact of language aptitude on language proficiency over time, it included results from two versions of the DLPT, IV and V, and did not consider other individual difference measures such as attitude, GPA, age, education level, billet type, or sex. The dataset for the current study only included results from DLPT V and did not only rely on converted ILR ratings, but instead used DLPT raw scores for the individual language analyses.

Wagener (2016) also investigated the predictive validity of aptitude measures over time using the DLAB, ASVAB, and four sets of DLPT reading and listening scores. For this study, the ASVAB scores were broken up into four scores: arithmetic reasoning (AR), math knowledge (MK), word knowledge (WK) and paragraph comprehension (PC). For the DLPT listening results, AR, MK, and DLAB were the significant predictors for the first exam cycle, and the AR, MK, and DLAB had the greatest impact on the other testing cycles as well; however, the magnitude of their standardized β coefficients continued to decrease with each successive testing cycle. The DLPT reading results were similar to the DLPT listening results. The AR, MK, and DLAB were the significant predictors for the first exam cycle, and they remained the significant predictors for the other testing cycles; however, the magnitude of their standardized β coefficients continued to decrease with each successive testing cycle. The results also revealed that the relationships between the ASVAB and DLAB and GPA vary between individuals assigned to languages in different difficulty categories. While this study investigated the impact of language aptitude on language proficiency over time, it did not consider other individual difference measures such as attitude, age, education level, number of language training hours, billet type, or sex. In addition, this study did break up the ASVAB scores into separate scores, but it did not do the same for the DLAB, which also has four separate sections: biographical data, spoken stress, deductive rule application, and inductive pattern application. It would be helpful to not only examine the overall DLAB scores, but the scores that compose the overall score.

Doughty (2019) investigated the use of the MLAT and Hi-LAB as predictors of language learning success at the Foreign Service Institute (FSI) and the extent to which aptitude predicts language learning success above and beyond other non-aptitude variables, such as prior language learning experience. Aptitude (MLAT, Hi-LAB) and prior experience learning other languages at FSI predicted success on the FSI Proficiency test, which tests speaking and reading, when the participants completed their training on-time (without extensions). This was true for participants with limited working proficiency (2/2 according to the ILR scale) and general professional proficiency (3/3 according to the ILR scale). For those participants that required one or two extensions to reach the desired level of proficiency (eventual success), aptitude and prior experience predicted success for participants with limited working proficiency; however, only aptitude predicted success for participants with general professional proficiency. Aptitude and prior learning success both predicted on-time and eventual success for those students studying easier (Category I, see Table 1) languages; however, only aptitude (MLAT, Hi-LAB) predicted success for students studying harder (Category III and IV, see Table 1) languages. The MLAT was a better predictor for success in Category I languages and the Hi-LAB was a better predictor for Category IV languages. Aptitude was better at predicting both on-time and eventual success than prior language learning experience.

Other studies have investigated language proficiency change but have not included aptitude as a predictor variable. For example, Bloomfield et al. (2014) investigated how listening, reading, and speaking language proficiency test ratings of over eight hundred Defense Intelligence Agency foreign language professionals (and over 50 different languages) changed over time using a data mining approach. The results indicated that the foreign language reading and listening proficiency test scores improved, but the speaking foreign language proficiency scores did not. In addition, participants with higher initial reading proficiency ratings tended to experience higher rates of improvement than those participants with lower initial reading proficiency ratings. The opposite was true, however, for listening. Participants with lower initial listening proficiency ratings tended to experience higher rates of improvement than those with higher initial listening proficiency ratings. Therefore, it could be that once foreign language professionals reach higher levels of proficiency, it is easier for them to improve in their reading proficiency than their listening proficiency. This may be because it is easier to access higher level texts than it is to access listening resources at the higher levels (e.g., debates).

Previous research has shown that measures of language aptitude, such as the MLAT and DLAB, can predict foreign language proficiency outcomes beyond that predicted by general intelligence measures. In addition, the research indicates that for military language professionals at DLI, reading and listening proficiency improves. However, what is not clear is the relationship between language aptitude and its impact on language proficiency change over time. The previous research provides limited insight into the potential impact of other individual difference factors. In addition, by breaking up ASVAB and DLAB into the scores that make up the overall scores, it will be possible to get a clearer picture regarding which cognitive and non-cognitive factors impact the change in language proficiency over time. To address this gap in the literature, a longitudinal study with multiple sets of foreign language proficiency test results from the same participants over a period of time is needed. This study includes variables such as the ASVAB, GPA, and attitude scores to add insight to the results from previous studies and the relationship between language aptitude and other cognitive and non-cognitive variables and their combined impact on language proficiency outcomes.

Additional Variables

When investigating the variables that impact language proficiency change of DLIFLC graduates, researchers have often gone beyond the individual difference factors that are generally included in second language acquisition studies and consider the potential effect of other variables. Previous research that has used data from DLIFLC graduates or similar populations has found that variables including education level, gender, service, number of previous languages studied, DLI Language Difficulty Category (according to DLIFLC, see Table 1), GPA, and age may impact success at DLIFLC and language learning proficiency change over time. Another important variable that has been considered is student status. While trying to successfully complete their studies at DLIFLC, students may complete the program as originally assigned, "recycle" into the same language in a later class, "relanguage" into a different language (usually a language of lesser difficulty) or drop out of the program.

In their study with U.S. Department of State employees, Ehrman and Oxford (1995) found that several of the demographic variables they included in their study correlated with reading and speaking proficiency including education level (speaking: 0.34; reading: 0.32), age (speaking: 0.27; reading: not significant), and number of previous languages studied (speaking: 0.34; reading: 0.32). The results did not reveal any relationship between gender and reading or speaking proficiency. Arthur (1996) specifically investigated the effect of gender of attrition rate at DLIFLC and found that gender was only significant for DLIFLC students in the Air Force. The higher overall attrition rate for females in the Air Force, however, was most likely due to their lower paygrades and the more difficult language categories that they were assigned to, not their gender. Hinson (2005), however, did find an effect for gender in their investigation of the influence of factors on DLIFLC graduates' success after leaving DLIFLC. Hinson (2005) used classification trees and logistic regression and found that males were more likely to succeed after graduating DLIFLC than females. Success was defined as the service members' completing their contractual enlistment obligation and maintaining their language proficiency (determined by whether or not they received Foreign Language Proficiency Pay (FLPP)). Hinson (2005) also found that service members in the Air Force and Marine Corps were more likely to succeed than those in the Army, and although AFQT scores also predicted success, too many observations were missing to make any conclusions regarding those results.

Wong (2004) examined factors affecting students' success at DLIFLC and found that the results varied by the category of language the students studied. For category I languages, students with higher DLAB scores and those who were not recycled or relanguaged were more likely to graduate; service and gender were not significant variables. For category III languages, gender, service, and whether or not a student had been recycled impacted probability of graduation. Females in the Marines that had DLAB scores of 95 or higher were most likely to graduate while males in the Army with DLAB scores less than 95 were the least likely to graduate. For the students who had not been recycled before, students in the Marines were most likely to graduate, followed by the Navy, Air Force, and Army. However, for those students who had been recycled at least once before, students in the Air Force were the most likely to graduate, followed by the Army, the Marines, and the Navy. For category IV languages, female students in the Navy having DLAB scores of 120 or higher who had not been recycled or relanguaged had the highest probability of graduation, while males in the Army with DLAB scores of less than 120 who had been recycled or relanguaged at least once had the lowest probability of graduation.

Shearer (2013) investigated the factors that impact the language proficiency loss of military linguists after they leave DLIFLC and found that higher language proficiency linguists maintain their proficiency for a longer amount of time and experience less language loss than those with lower language proficiency and GPA is associated with military linguists' performance on the DLPT. The results also suggested that language category may play a role in second language proficiency change, but that gender does not appear to impact language proficiency change or loss. DeRamus (1999) conducted a study with only Arabic and Persian DLIFLC students and found that cumulative GPAs were the better predictors of success on the DLPT than semester GPAs or language program tests.

Haupt (2017) investigated the factors that contributed to the attrition of DLIFLC students in the Korean language program. The logistic regression models from this study predicted student success at different milestones: the beginning of semester 1, 2, and 3, and after graduation but before the DLPT. Pay grade, service branch, DLAB scores, in status (recycled or initial entry), prior language proficiency, and semester GPAs all proved to be significant indicators of students who were at-risk for attrition. Bermudez-Mendez (2020) also investigated DLIFLC students' probability of success at different stages of their language programs by using stepwise logistic regression models, but with a larger population of students. This study included a variety of independent variables, and the dependent variable was whether or not the student achieved a 2+ (on the Interagency Language Roundtable (ILR) Scale) in listening and reading on the DLPT. Military service was one of the variables that was dropped as it was not found to be significant. Language category was significant, with category IV students having better odds of success than category I and category II students, category III students having better odds of success than category I students, and category II students having better odds than category I students. This finding is interesting given that category I students are assigned to what are thought to be the easiest languages taught at DLIFLC. The results also revealed that students with higher DLAB scores were more likely to succeed than those with lower scores. Recycled students had worst odds of success than relanguaged and initial entry students. In addition, prior experience as a language instructor, transcriber, or translator all improved odds of students' success. Lastly, better grades in advanced and intermediate language classes increased students' odds of success.

The research that has previously conducted with DLIFLC students and similar populations suggests that factors such as students' GPA, gender (sex), and DLI Language Difficulty Category may all potentially impact language proficiency outcomes. Therefore, the current study considers these factors in the analysis.

Despite the decades of research that has been dedicated to investigating the impact of individual difference factors on second language learning, there are still critical gaps in the literature. While smaller scale studies have found that general cognitive ability (as measured by the ASVAB) predicts training outcomes for foreign language professionals, these studies did not provide insight into the impact of general cognitive ability on language proficiency change. Similarly, results from previous research have shown that language aptitude (as measured by the DLAB and MLAT) can predict foreign language proficiency outcomes; however, the impact that language aptitude has on language proficiency change remains unclear. In addition, most of the studies investigating the impact of general cognitive ability and language aptitude on language training outcomes or language proficiency did not include L2 attitude in their analysis. While the current literature on attitude towards learning an L2 suggests that it positively impacts L2 proficiency, a longitudinal study is needed to understand the potential long-term impact and how it interacts with language aptitude and general cognitive ability. In addition, previous studies that used the DLPT as an outcome or dependent variable used converted ILR ratings, which permit researchers to conduct analyses containing multiple languages at the same time since ILR ratings are equated across languages; however, the raw DLPT scores provide a more precise measure of reading and listening proficiency. The current study filled existing gaps in the literature by using a longitudinal design to investigate the impact of individual difference factors on language proficiency change. The current study has three main predictors: general cognitive ability (as measured by the ASVAB), language aptitude (as measured by the DLAB), and attitude towards learning the assigned L2 (measured by the DLIFLC motivation survey). The language proficiency outcomes are participants' DLPT reading and listening scores. Converted ILR ratings were used for Phase I; however, this study is unique in its use of DLPT raw scores, which were used for all individual language analyses in Phases II, III, and IV. The currently study also investigates the influence of additional factors the literature suggests may impact language proficiency growth: placement into a particular DLI Language Difficulty Category, GPA, age, educational level, number of language training hours, billet type, and sex.

Chapter 3: Methodology

Dataset

The data used in this study came from existing records at the DLIFLC and DOD. The participants in this study graduated from DLIFLC between 2011 and 2020. All participants have at least three DLPT scores. Participants with fewer than three scores were excluded from this study due to the longitudinal nature of the analysis. The overall analysis (Chapter 4) included 17,891 records (rows with at least three repeated measures of the DLPT); the DLPT Listening analysis included 10,245 records and the DLPT Reading analysis included 7,646 records. The description of each subsequent analysis (Chapter 4 and 5) indicates the number of records included in that specific analysis.

Variables

Defense Language Proficiency Test (DLPT)

The outcome variables for this study are the Defense Language Proficiency Test (DLPT) results for reading and listening. The DLPT is used world-wide by the Department of Defense (DOD) to measure listening and reading comprehension according to the Interagency Language Roundtable (ILR) Language Proficiency Scale. The DLPT reading and listening data were analyzed separately. Converted ILR scores (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2 + = 26) were used for the overall DLPT reading and listening growth analyses and the DLI Language Difficulty Category analyses (Chapter 4). Raw scores were used in the specific language analyses (Chapter 5). The converted ILR scores are comparable across languages, so when using data from multiple languages in an analysis, converted ILR scores were used. Raw scores are a more precise measurement because they indicate the number of correct answers. Unlike the ILR ratings (e.g., 0, 0+,1, 1+) and converted ILR scores (e.g., 0, 6, 10, 16), raw scores have not been altered in any way. They have not been weighted, transformed, or converted. However, raw scores cannot be used across languages because they are not equated across languages. Therefore, raw scores were only used in the individual language analyses.

Armed Services Vocational Aptitude Battery (ASVAB)

The Armed Services Vocational Aptitude Battery (ASVAB) was used in this study as a measure of general cognitive ability. The ASVAB is a multiple-aptitude battery that measures developed abilities and is used to help predict future academic and occupational success for military service members. It is administered to all military applicants. The ASVAB is composed of three different tests: Verbal, Mathematics, and Science/Technical. Each test has at least two subtests. The Verbal subtests are word knowledge (WK) and paragraph comprehension (PC). The Mathematics subtests are arithmetic reasoning (AR) and mathematics knowledge (MK). The Science/Technical subtests are general science (GS), electronics information (EI), auto information (AI), shop information (SI), mechanical comprehension (MC), and assembling objects (AO). See Table 2 for descriptions of the constructs measured by each subtest. The overall ASVAB score was used in the first set of analyses, Phases I and II. The overall ASVAB score and the subtests WK, PC, AR, and MK were included in Phases III and IV. Throughout the Results section, this variable will be referred to as COG (general cognitive ability).

Defense Language Aptitude Battery (DLAB)

The Defense Language Aptitude Battery (DLAB) was used in this study as a measure of language aptitude. The DLAB is a test used by the military services and Department of Defense to test an individual's ability to learn another language. The results from the DLAB determine who may pursue training for an occupation within the military that requires knowledge of a second language. The DLAB has four sections: a biographical questionnaire that includes questions about previous language learning experience, grades, study habits, and academic background (DLAB PT1); a test taken from the Al-Haik Foreign Language Auditory Aptitude Test (AFLAAT) that measures perception of speech patterns (DLAB PT2); a test that requires the examinee to apply grammar rules in an artificial language (DLAB PT3); and a test taken from HABLA, Horne's Assessment of Basic Linguistic Abilities, which requires the examinee to form language concepts from pictures using an artificial language (DLAB PT4). The overall DLAB score was used in the first set of analyses, Phase I and II. The overall DLAB scores and the subtests were included in Phases III and IV. Throughout the Results section, this variable will be referred to as APT (aptitude).

Attitude toward learning assigned language

Military service members who are selected to go to DLI are assigned a language to study. This decision is based on their DLAB scores. The service members do have an opportunity to provide input regarding the language(s) they would prefer to study. Once the military service members have received notification regarding their assigned language, they are required to complete a survey that includes a question regarding their attitude towards learning their assigned language. They are asked: *What is your level of motivation for studying to language you were assigned to?* The response options are:

1- Not my choice. I would prefer to do something else rather than study a foreign language;
2- Not my choice. I am not motivated to study the assigned language;
3- Not my choice, but I am still motivated to study the assigned language;
4- Based on my second or third choice;
5- Based on my first choice.

The results from this item will serve as the measure of attitude towards learning assigned language for this study. This is the measure of attitude that was available for this study. It was included in the analysis with the understanding that it is not ideal to measure a construct with a single Likert-scale item. Throughout the Results section, this variable will be referred to as ATT (attitude).

Age

In this study, the age of the participants is the age at which the military service members started their studies at DLI. Age was included as a predictor in the individual language analyses in Phases III and IV.

Grade Point Average (GPA)

Military service members studying at DLI are given grades for the courses they attend. The GPA used in this study is the participants' grade point average at DLI; the GPA that the participants earned while studying the language they tested in (DLPT). GPA was included as a predictor in the individual language analyses in Phases III and IV.

Sex

For the purposes of this study, sex is classified as male or female. Military service members chose either male or female as their sex upon entrance to DLI on the student questionnaire. The database storing the data collected from this questionnaire is the source of this data. For this study, female was coded as 0 and male was coded as 1. Sex was included as a predictor in the individual language analyses in Phases III and IV.

Education Level

Upon arrival at DLI, military service members indicate their level of education on the questionnaire they are asked to complete. The participants in this study had a range of education levels, the choices on the questionnaire are (1) Non-High school, (2) High School/GED equivalent, (3) 1 year of college, (4) 2 years of college, (5) 3 years of college, (6) 4 years of college, (7) Bachelor's degree, (8) Master's degree, (9) Doctorate. Education level was included as a predictor in the individual language analyses in Phases III and IV.

Number of hours of language training

Upon arrival at DOD, military service members typically attend language training every year. For this study, the number of hours of language training indicates the total number of training hours the military service members attended while at the DOD. Number of hours of language training was included as a time invariant predictor in the individual language analyses in Phases III and IV.

Billet type (military service or direct DOD)

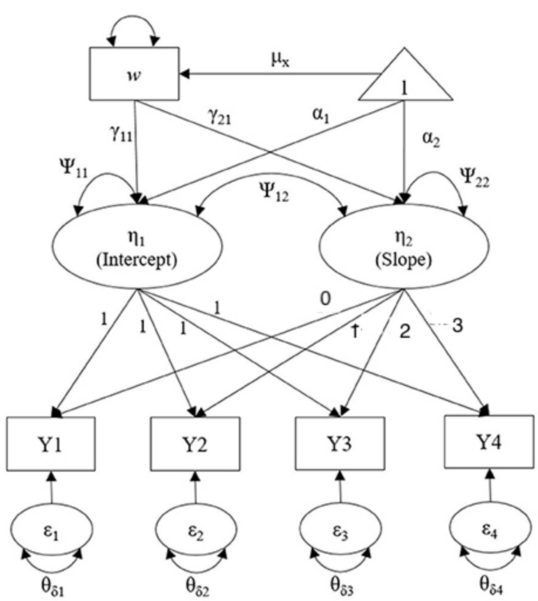
Military service members may be assigned to one of two types of billets at the DOD: a billet that is assigned to the military service branch (P2) or a billet that is assigned to the DOD itself (P3). The military service branches have more control over the billets assigned directly to them and it could be the case that those military service members on P2 billets are not using the language they studied on the job as frequently as those assigned to P3 billets. For this study, P2 was coded as 0 and P3 was coded as 1. Billet type was included as a predictor in the individual language analyses in Phases III and IV.

Data Analysis

The purpose of the current study was to investigate the change in language proficiency outcomes (DLPT scores) over time and the impact of individual difference factors such as cognitive ability, language aptitude, and attitude towards learning an L2 on the change in language proficiency outcomes. Therefore, this study used a statistical method that permitted an examination of participants' initial language proficiency levels and growth trajectories, an examination of between-participant variability in growth trajectories, and an investigation into the factors that may predict the changes in language proficiency outcomes. Latent growth modeling (LGM) is an approach based on structural equation modeling (SEM) that provides group-level statistics (mean intercept and mean growth rate) and individual-level statistics (variances of individual trajectories around group means), can test hypotheses about specific trajectories, and permits the inclusion of predictors in a model. Duncan and Duncan (2004) highlight some of the strengths of LGM, including "an ability to test the adequacy of the hypothesized growth form, to incorporate … covariates, to correct for measurement error in observed indicators, …and to develop from the data a common developmental trajectory, thus ruling out cohort effects." (p. 336) Figure 3 will be used to explain the basics of latent growth curve modeling and how the approach was used for the current study.

Figure 3

Path Diagram for a Typical Latent Growth Curve Model



Adapted from Kim, et al. (2018, p.5)

The squares represent measured variables, and in the case of the current study, the Ys are DLPT scores (language proficiency outcomes). Reading and listening DLPT scores were analyzed separately; therefore, for each path diagram the Ys are either be reading DLPT scores or listening DLPT scores. Y1 through Y4 are spaced repeated measures. In the case of the current study, most participants have taken the DLPT every year and only participants who took the DLPT at least three times (Y1, Y2, Y3) were included in the analysis. The ε under each Y represents residual or measurement error of each corresponding test occasion. Latent growth modeling has the advantage of being able to incorporate time-specific measurement error into a model. The $\Theta\varepsilon$ under each ε represents the variances of the measurement error or the residual variances. The residual variances represent the portion of the variance at each test occasion not explained by the latent trajectory (the intercept and slope). The circles are labeled as the intercept and the slope, the latent variables $\eta 1$ and $\eta 2$. The latent variables are expressed as latent means, $\alpha 1$ (intercept) and $\alpha 2$ (slope). The intercept indicates the initial level of the measured variable (or the level of the outcome measure, Y, at which the time variable equals zero). For the current study, this is the participants' average DLPT scores at graduation from DLIFLC. The slope indicates the average rate at which the outcome measure changes; for this study, the average rate at which the DLPT scores change. (For a complex nonlinear model, there may be more than one slope.) The triangle in Figure 3 represents a constant.

The lines from the intercept and the slope to the Ys are factor loadings/parameters for the intercept and slope. The 4 lines from the intercept to the Ys are all set to 1 to indicate that there is no hypothesized change in the measured variable from Y1 to Y4. Having these values the same establishes the initial (also called the constant) level of the outcome variable; for the current study, the average DLPT score at graduation from DLIFLC. It establishes the level of the DLPT scores if the participants experienced no change in DLPT scores from Y1 to Y4. The first line from the slope to Y1 is set to 0 because Y1 is the initial level of the outcome variable, so there has been no change in the outcome variable at this point. The other paths in this case are set to 1, 2, 3, and 4 in Figure 3, which would imply that there is a linear growth curve. (In the case of the current study, there were 5 test occasions, and these were set to 0, 0.25, 0.50, 0.75 and 1 for the linear models.) However, if a non-linear curve is expected, or if it is found that the linear model does not fit the data well, then the first parameter could be set to 0 and the last to 1 or another value and the rest of the factor loadings could be estimated based on the data itself. The $\Psi 11$ in Figure 3 represents the intercept variance, or the extent to which the participants' intercepts (initial DLPT scores) deviate from the model's intercept (mean of the initial DLPT scores), and the $\Psi 22$ represents the slope variance, or the extent to which the participants' slopes vary from the model's slope (mean of the rate of change of DLPT scores). The $\Psi 21$ represents the covariance of the intercept and slope variances.

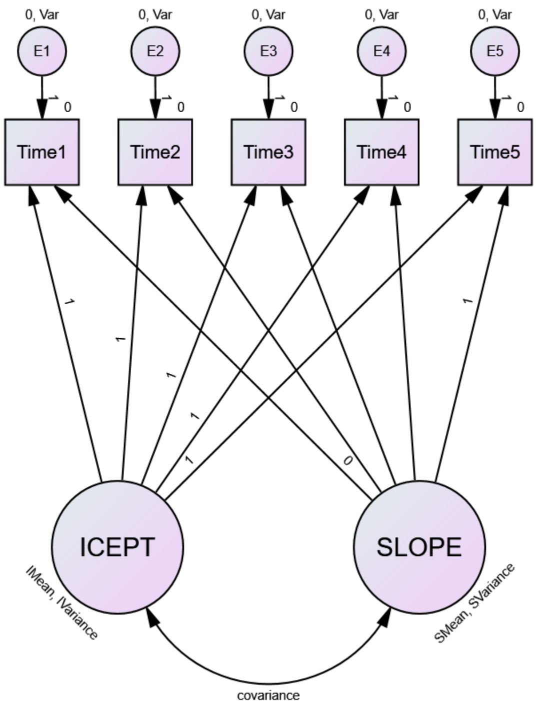
The rectangle represents a predictor variable, w. The path coefficients, $\gamma 11$ and $\gamma 21$, represent the relationship of the variable to the initial value of the outcome variable and the change in the outcome variable. Latent growth curve modeling not only permits the inclusion of predictors, but it allows the researcher to speculate as to whether a predictor will influence the initial level of the outcome variable (the intercept), the rate of change in the outcome variable (the slope), or both. Covariances indicate if the predictors interact.

Planned Analyses: Phases

The analyses for this study were conducted in four phases. Phase I involved running latent growth prediction models using converted ILR ratings (1 = 10, 1+ = 16, 2 = 20, 2+ = 26, etc.) for the entire DLPT Listening and DLPT Reading datasets without predictors (for results see Chapter 4). Figure 4 is an example of a path diagram that does not include predictors, such as those used in the first part of Phase I.

Figure 4

Example Path Diagram: Phase I

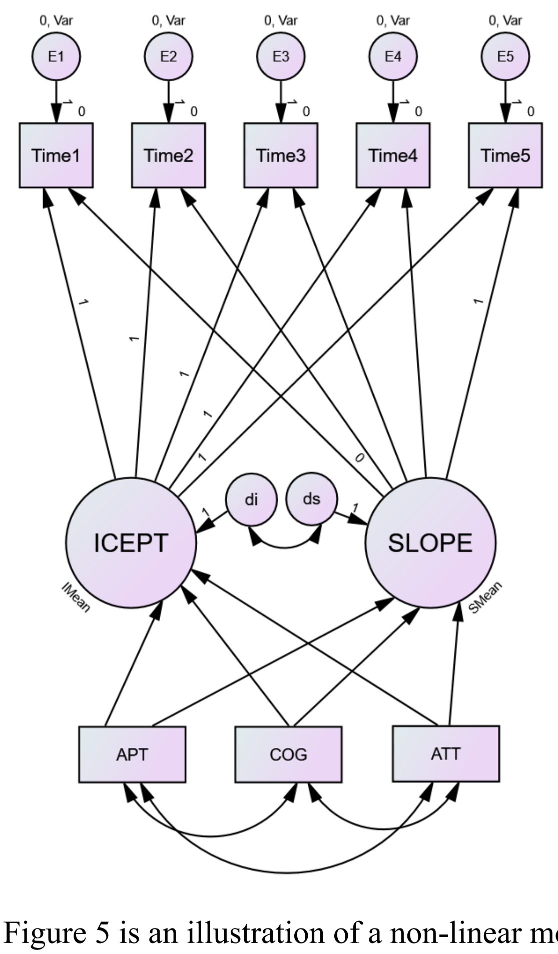


Note: Figure 4 is an illustration of a non-linear model. (Time1 is set to 0 and Time5 is set to 1.)

Phase I also included running latent growth prediction models using ILR ratings for the DLPT Listening and DLPT Reading datasets for DLI Language Difficulty Categories I, III, and IV languages with the three main predictors: cognitive aptitude (COG), language aptitude (APT), and attitude towards language learning (ATT) (for results see Chapter 4). Predictors were entered into the models one at a time in the order of expected importance. Figure 5 is an example of a path diagram that includes the three main predictors (APT, COG, and ATT), such as those used in the second part of Phase I for the DLI Language Difficulty Category analyses. COG was entered first for the DLI Language Difficulty Category I analysis, and APT was entered first for the DLI Language Difficulty Category III and IV analyses because existing literature (Lett & O'Mara, 1990; Doughty, 2019) suggests general cognitive aptitude (COG) is likely to have more of an impact on DLI Language Difficulty Category I language outcomes and language aptitude (APT) is likely to have more of an impact on DLI Language Difficulty Category III and IV language outcomes.

Figure 5

Example Path Diagram: Phases I & II



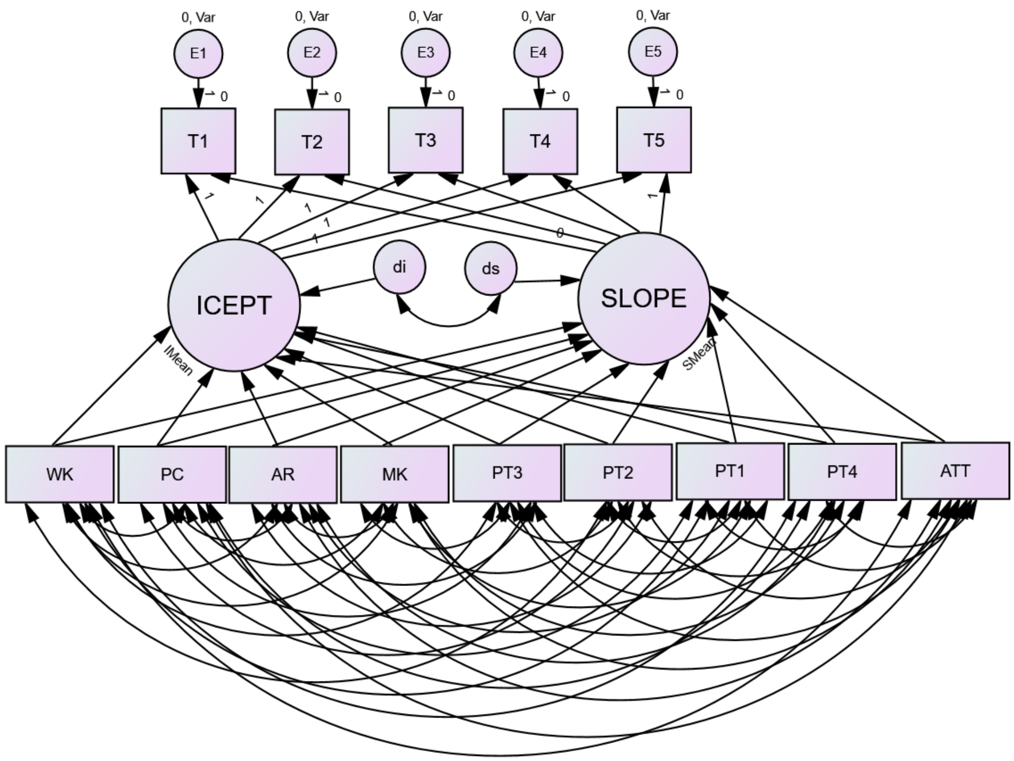
Note: Figure 5 is an illustration of a non-linear model. (Time1 is set to 0 and Time5 is set to 1.)

Phase II involved running latent growth prediction models for the DLPT Listening and DLPT Reading datasets for individual languages using raw scores (not converted ILR ratings) with the three main predictors (COG, APT, and ATT). Predictors were entered into the models one at a time in the order of expected importance. Figure 5 is an example of a path diagram that includes the three main predictors (APT, COG, and ATT), such as those used in Phase II. While the path diagrams are the same for the second part of Phase I and Phase II, the datasets were different in two ways. First, converted ILR ratings were used as the outcome variable for Phase I and raw scores were used as the outcome variable for Phase II. Second, the second part of Phase I used datasets that grouped languages by DLI Language Difficulty Categories I, III and IV while Phase II used datasets separated by language (Spanish, Persian, Russian, Chinese, Korean, Arabic).

Phase III involved running latent growth prediction models for the DLPT Listening and DLPT Reading datasets for individual languages using raw scores. Only the subtests of the predictor variables that were significant in Phase II were entered into the models. ATT was entered into the models if it was significant in Phase II. Predictors were entered into the models one at a time in the order of expected importance. Figure 6 is an example of a path diagram that includes all the predictors entered into the models in Phase III (ASVAB and DLAB subtests and ATT).

Figure 6

Example Path Diagram: Phase III

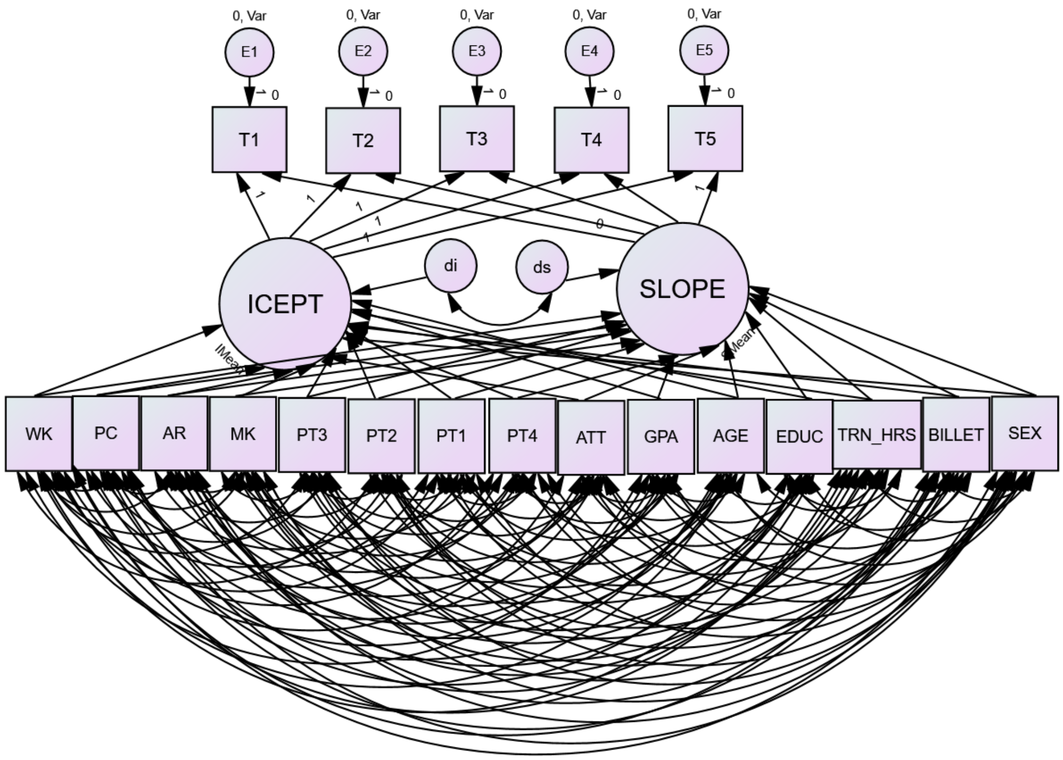


Note: Figure 6 is an illustration of a non-linear model. (Time1 is set to 0 and Time5 is set to 1.)

Phase IV involved running latent growth prediction models for the DLPT Listening and Reading datasets for individual language using raw scores with the subtests of the predictor variables that were significant in the previous analysis (Phase III), ATT if significant in Phase III, and additional predictor variables expected to impact language proficiency change over time (GPA, age, education level (EDUC), number of language training hours (TRN_HRS), billet, sex). Predictors were entered into the models one at a time in the order of expected importance. For the results from Phases II to IV see Chapters 5. Figure 7 is an example of a path diagram that includes all the predictors entered into the models in Phase IV (ASVAB and DLAB subtests, ATT, GPA, AGE, EDUC, TRN_HRS, BILLET, SEX).

Figure 7

Example Path Diagram: Phase IV



Note: Figure 7 is an illustration of a non-linear model. (Time1 is set to 0 and Time5 is set to 1.)

Procedures for Data Analysis

IBM SPSS Statistics (Version 28.01) was used to examine descriptive statistics and distributional characteristics of the data. SPSS AMOS (Version 28 for Windows) was used to conduct final statistical analyses. The minimum suggested number of participants required for latent growth curve models is 200 (Byrne, 2001; Murphy et al., 2014). In the current study the number (*N*) of participants varied between analyses, but each analysis had at least 200 participants. Data were reviewed using standard data cleaning procedures. Skewness and kurtosis were examined. Skewness < -1 or > +1 and kurtosis < -1 or > +2 indicated non-normality. Descriptive statistics studied indicated some non-normality in the data set. Therefore, all latent growth curve analyses were conducted using robust maximum likelihood estimation (MLR) as MLR accounts for non-normality in the data set (West et al., 1995). Predictor variables were standardized so that the scores could be compared even though they were measured on different scales. This was done by calculating the mean and standard deviation for each variable and then subtracting the mean from each observed value of the variable and dividing by the standard deviation. The two exceptions to this are billet and sex because they are both categorical variables with two levels. When there was missing data, a full information maximum likelihood (FIML) approach was used. This approach has been shown to produce unbiased parameter estimates and standard errors when data are missing completely at random (MCAR) or missing at random (MAR) (Enders & Bandalos, 2001). MCAR indicates that the probability of data being missing is the same for all participants and MAR indicates that the probability of being missing is the same only within groups defined within the dataset. The missing data in this study is most likely missing MCAR, but it is at least MAR, and so the use of FIML is appropriate for this study. FIML works by estimating a likelihood function for each participant based on the variables that are present in the dataset so that all available data is used. The FIML is available as a part of SPSS AMOS. In addition, pairwise comparisons were performed to investigate if participants with fewer test records in the dataset were significantly different than those with more test records in terms of their DLPT results at test occasion 3, general cognitive ability (ASVAB), language aptitude (DLAB), and GPA (see Results: Chapter 4). There were no obvious patterns in the missing data. Some participants did not have more than three test occasions. This is not surprising because after test occasion 3, most military service members would have completed their first term with the military. They likely only have three test occasions because they decided to separate from the military for reasons not relevant to this investigation.

Model fit statistics were analyzed to assess the adequacy of the model fit to the data of each of the models tested (Song, 2011; Song et al., 2009). The Comparative Fit Index (CFI) is derived from the comparison of a hypothesized model with the independence (or null) model. It provides a measure of the complete covariation in the data. The CFI range is between 0 and 1. A CFI value above .9 (Bentler, 1992) or closer to .95 (Hu & Bentler, 1999) indicates an acceptable fit. The Root Mean Square Error of Approximation (RMSEA) considers the error of approximation of the population and analyzes the discrepancy between the hypothesized model and the population covariance matrix. Values of RMSEA range from 0 to 1. RMSEA is sensitive to the number of parameters in a model or the complexity of a model. An RMSEA value of less than .08 signifies a good fit, of between .08 and .1 an adequate fit, and of more than .1, a poor fit (Hu & Bentler, 1999). The use of RMSEA has been strongly recommended by MacCallum and Austin (2000) because:

(a) it appears to be adequately sensitive to model misspecification (Hu & Bentler, 1998)
(b) commonly used interpretative guidelines appear to yield approximate conclusions regarding model quality (Hu & Bentler, 1998, 1999)
(c) it is possible to build confidence intervals around RMSEA values (Byrne, 2001).

The 90% confidence interval around the value of the RMSEA, reported by AMOS, should be used to assess the precision of the RMSEA estimate (MacCallum, 1996; Steiger, 1990). In addition, the probability value of the test of close fit, the *p*-value should be > .50. The chi-square test (χ^2), used to examine the amount of difference between expected and observed covariance matrices for each model tested, is highly sensitive to sample size (Ullman & Bentler, 2012). The larger the sample size, the more likely a significant chi- square occurs (DeRoche, 2009). Therefore, while the chi-square statistics are reported, they were not used to evaluate absolute model fit due to the sensitivity of this statistic to sample sizes. Both CFI and RMSEA were used to evaluate absolute model fit.

To the author's knowledge, only one known study has used latent growth curve modeling to investigate language proficiency growth over time using data from DLIFLC graduates. Mackey (2014) used latent growth curve modeling (LGM) to investigate how aptitude related to language proficiency outcomes over time and used two sets of trajectories: one for DLPT listening scores and one for DLPT reading scores. Mackey (2014) found that a non-linear growth model best fit the data; the mean intercept was just over ILR Level 2 for DLPT listening and closer to ILR Level 2+ for DLPT reading. The mean slopes for both listening and reading were positive but not significant; therefore, there was not much change in the mean tests scores over time. In addition, Mackey (2014) found that language difficulty category (language difficulty category was determined by using DLIFLC's guidelines—see Table 1) had a significant, negative impact on the intercepts but not the slopes. The ASVAB (AFQT) had a significant, positive impact on the intercepts but not the slopes. The DLAB did not have a significant impact on the intercept for DLPT listening, but it did explain a small amount of between-person variance for those who did show growth in language proficiency over time. For the DLPT reading, the DLAB had a significant, positive impact on the intercept and a significant, positive impact on the slope.

The current study expands upon the research conducted by Mackey (2014) by including attitude towards language learning as a predictor variable, including the subtests of the ASVAB and the DLAB, using a larger data set (data from DLIFLC graduates from 2011 to 2020), and using DLPT raw scores along with ILR ratings. The current study also included other variables that may impact language proficiency growth over time including: GPA, age, education level, number of hours of language training, billet type, and sex. In addition, instead of using language difficulty category as a predictor variable, the current study will use separate analyses to examine the growth trajectories across DLI Language Difficulty Categories and languages and compare the parameters.

Chapter 4: Results: Phase I

In this chapter, Phase I analyses will be summarized. The purpose of Phase I was to conduct analyses that would provide insight into the mean growth trajectories of the overall DLPT Listening and Reading populations and the DLI Language Difficulty Category II, III, and IV populations. The other purpose was to conduct analyses to determine the impact of general cognitive ability, language aptitude, and attitude towards learning assigned language on the initial language proficiency levels and language proficiency change of the participants in the DLI Language Difficulty Category II, III, and IV Listening and Reading populations. The descriptive statistics, the model fit statistics, and the growth parameter statistics from the base DLPT Listening, DLPT Reading, DLI Language Difficulty Category II, III, and IV Listening and Reading analyses will be summarized. This chapter also includes a summary of the results from the models with the main predictor variables (cognitive ability, language aptitude, and attitude towards language learning) for DLI Language Difficulty Categories I, III, and IV. Model fit statistics, parameter statistics, and regression weights are provided within the text, and variance and covariances are provided in the Appendix. Table 3 provides a summary of the models included in Phase I.

Table 3. Phase I Analyses and Models.

Dataset	Models
DLPT Listening	1AA (linear)
	1A (non-linear)
DLPT Reading	2AA (linear)
	2A (non-linear)
DLI Difficulty Category I	3AA (linear)
Languages: DLPT Listening	3A (non-linear)*
	3B (3A + COG)
	3C (3B + APT)
	3D (3C + ATT)
DLI Difficulty Category I	4AA (linear)*
Languages: DLPT Reading	4A (non-linear)
	4B (4AA + COG)

Dataset	Models
	4C (4AA + APT) 4D (4B + ATT)
DLI Difficulty Category III Languages: DLPT Listening	5AA (linear) 5A (non-linear)* 5B (5A + APT) 5C (5B + COG) 5D (5C + ATT)
DLI Difficulty Category III Languages: DLPT Reading	6AA (linear) 6A (non-linear)* 6B (6A + APT) 6C (6B + COG) 6D (6C + ATT)
DLI Difficulty Category IV Languages: DLPT Listening	7AA (linear) 7A (non-linear)* 7B (7A + APT) 7C (7B + COG) 7D (7C + ATT)
DLI Difficulty Category IV Languages: DLPT Reading	8AA (linear) 8A (non-linear)* 8B (8A + APT) 8C (8B + COG) 8D (8C + ATT)

*selected as base model due to better model fit

Note: COG = cognitive aptitude as measured by the ASVAB. APT = language aptitude as measured by the DLAB. ATT = attitude towards learning the assigned language as measured by an attitude Likert item.

DLPT Listening Results

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for DLPT listening was 10,245 records. ILR ratings were converted to scores (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2+ = 26, 3 = 30). The descriptive statistics for the DLPT listening sample are shown in Table 4. 69.4% of the sample had four test occasions, 43.1% had five test occasions, 23.6% had six test occasions, and 13.1% had seven test occasions. (Models in the analysis will only include five test occasions.) Pairwise comparisons were performed to investigate if participants with three test records in the dataset were significantly different than those with five test records in terms of their scores on test occasion 3, general cognitive ability (ASVAB), language aptitude (DLAB), and GPA (included in Phase IV). There was not a significant difference between the groups' scores at test occasion 3 ($t(7451) = -1.921$, $p = .055$). Participants who had 5 test occasions only scored slightly higher ($M = 22.27$, $SD = 6.0$) on the DLPT Listening at test occasion 3 than those who had 3 test occasions ($M = 22.00$, $SD = 5.89$). There was also not a significant difference found between the groups' ASVAB scores ($t(7451) = 1.892$, $p = .059$). Participants who had 5 test occasions scored slightly lower ($M = 91.38$, $SD = 7.22$) on the ASVAB than those who had 3 test occasions ($M = 91.71$, $SD = 7.60$). In addition, a significant difference was not found between the groups' DLAB scores ($t(7451)=1.933$, $p = .053$). Participants who had 5 test occasions scored slightly lower ($M = 118.27$, $SD = 12.40$) on the DLAB than those who had 3 test occasions ($M = 118.83$, $SD = 12.47$). There was also not a significant difference found between the groups' GPAs ($t(7451) = 1.772$, $p = .076$). Participants who had 5 test occasions had slightly lower GPAs ($M = 3.44$, $SD =.325$) than those who had 3 test occasions ($M = 3.46$, $SD = .348$).

Figure 8 displays the mean DLPT listening scores at each test occasion. The average listening proficiency stayed in the ILR level 2 range from test occasion one to seven, indicating slight growth over time. The average proficiency levels did increase overall except from Time1 to Time2, where there was a slight drop. The *SDs* and variances indicate that there are between participant differences in scores and that the spread between participants decreases slightly from one test occasion to the next. The skew and kurtosis values show that the distributions of listening scores at all test occasions are slightly negatively skewed and that for most test occasions the scores are slightly platykurtic.

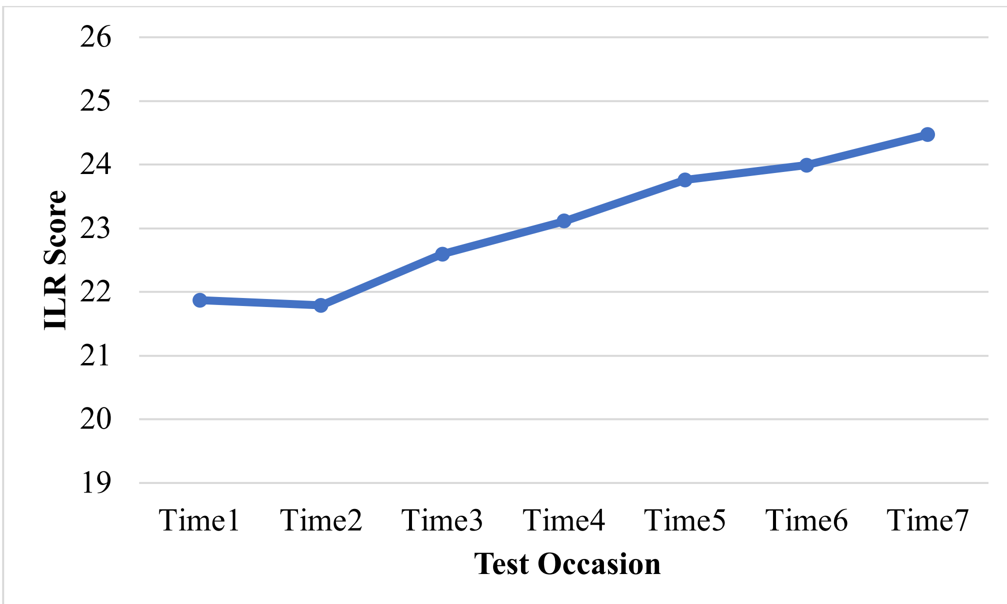
Table 4. DLPT Listening Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	10245	21.87	.055	5.548	30.785	-.336	.024	-.009	.048
Time2	10245	21.79	.054	5.471	29.930	-.266	.024	-.165	.048

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time3	10245	22.59	.054	5.475	29.977	-.371	.024	-.280	.048
Time4	7111	23.11	.063	5.275	27.830	-.396	.029	-.293	.058
Time5	4412	23.76	.077	5.092	25.924	-.564	.037	.037	.074
Time6	2417	23.99	.103	5.045	25.450	-.532	.050	-.207	.100
Time7	1347	24.47	.133	4.885	23.862	-.603	.067	-.307	.133

Figure 8

Mean DLPT Listening Scores by Test Occasion



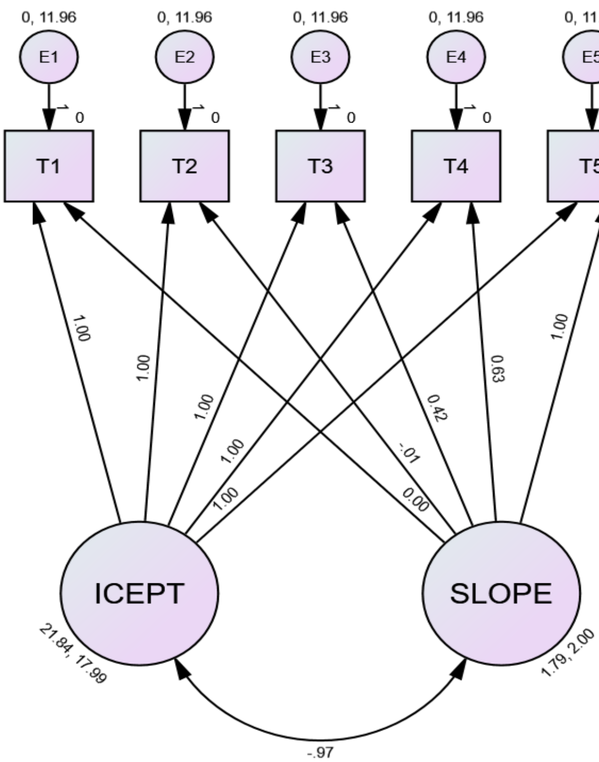
To investigate the general language proficiency change over the test occasions without any predictors, two growth models, linear and non-linear, were compared. The linear model, Model 1AA, assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 1A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 1A indicated a better model fit (χ^2= 441.56, *df* = 11, *p* = .00; CFI = .976; RMSEA = .006, CI = .006 - .007) than Model 1AA (χ^2=

531.64, *df* = 14, *p* = .00; CFI = .971; RMSEA = .006, CI = .006 - .006). This was not surprising given the slight curve in Figure 8. Therefore, Model 1A was accepted as the base model.

The resulting path diagram is shown in Figure 9. The residual variances were all positive and significant (E1= 11.959, *SE* = .108, CR = 110.852, $p < .001$; E2= 11.959, *SE* = .108, CR = 110.852, $p < .001$; E3= 11.959, *SE* = .108, CR = 110.852, $p < .001$; E4= 11.959, *SE* = .108, CR = 110.852, $p < .001$; E5= 11.959, *SE* = .108, CR = 110.852, $p < .00$). The mean slope was positive and significant ($M = 1.79$, $p < .001$) indicating that the DLPT listening scores increased slightly (given the small value) over time. The mean intercept was significant ($M = 21.83$, $p < .001$) indicating that the average initial score on the DLPT Listening was ILR Level 2 (20 – 25). The significant negative covariance between the slope and the intercept (-.969, $p < .001$) indicates that higher initial scores on the DLPT Listening were associated with lower rates of change and that lower initial scores on the DLPT Listening were associated with higher rates of change over time. The slope variance (2.00, $p < .001$) was significant indicating that there were significant inter-participant differences in language proficiency change over the five test occasions. The intercept variance (17.787, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial DLPT Listening score.

Figure 9

Path Diagram DLPT Listening: Phase I Model 1A



DLPT Reading Results

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for DLPT reading was 7,646 records. ILR ratings were converted to scores (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2+ = 26, 3 = 30). The descriptive statistics for the DLPT reading sample are shown in Table 5. 74.3% of the sample had four test occasions, 48.3% had five test occasions, 27.6% had six test occasions, and 15.6% had seven test occasions. (Models in the analysis will only include five test occasions.) Pairwise comparisons were performed to investigate if participants with three test records in the dataset were significantly different than those with five test records in terms of their scores on test occasion 3, general cognitive ability (ASVAB), language aptitude (DLAB), and GPA (included in Phase IV). There was not a significant difference between the groups' scores at test occasion 3 ($t(5632) = 1.454$, $p = .146$). Participants who had 5 test occasions scored slightly lower ($M = 24.49$, $SD = 4.44$) on the DLPT Reading at test occasion 3 than those who had 3 test occasions ($M = 24.69$, $SD = 5.52$). There was also not a significant difference found between the groups' ASVAB scores ($t(5632) = -.244$, $p = .823$). Participants who had 5 test occasions scored slightly higher ($M = 91.00$, $SD = 7.73$) on the ASVAB than those who had 3 test occasions ($M = 90.95$, $SD = 8.22$). In addition, a significant difference was not found between the groups' DLAB scores ($t(5632) = 1.779$, $p = .075$). Participants who had 5 test occasions scored slightly lower ($M = 116.82$, $SD = 12.25$) on the DLAB than those who had 3 test occasions ($M = 117.44$, $SD = 12.51$). There was also not a significant difference found between the groups' GPAs ($t(5632) = 1.917$, $p = .055$). Participants who had 5 test occasions had slightly lower GPAs ($M = 3.45$, $SD = .33$) than those who had 3 test occasions ($M = 3.47$, $SD = .36$).

Figure 10 displays the mean DLPT reading scores at each test occasion. The average reading proficiency stayed in the ILR level 2 range from test occasion one to seven, and only went up from 24.51 to 25.94 indicating a very small amount of growth. The average proficiency levels did increase overall except from Time1 to Time2, where there was a slight drop. The *SDs* and variances indicate that there are between participant differences in scores. The spread between participants does not follow a consistent pattern as it increases up to Time3 and then decreases. The skew values show that the distributions of reading scores at all test occasions are slightly negatively skewed. The kurtosis values show that for most test occasions the scores are slightly leptokurtic and for two they are slightly platykurtic.

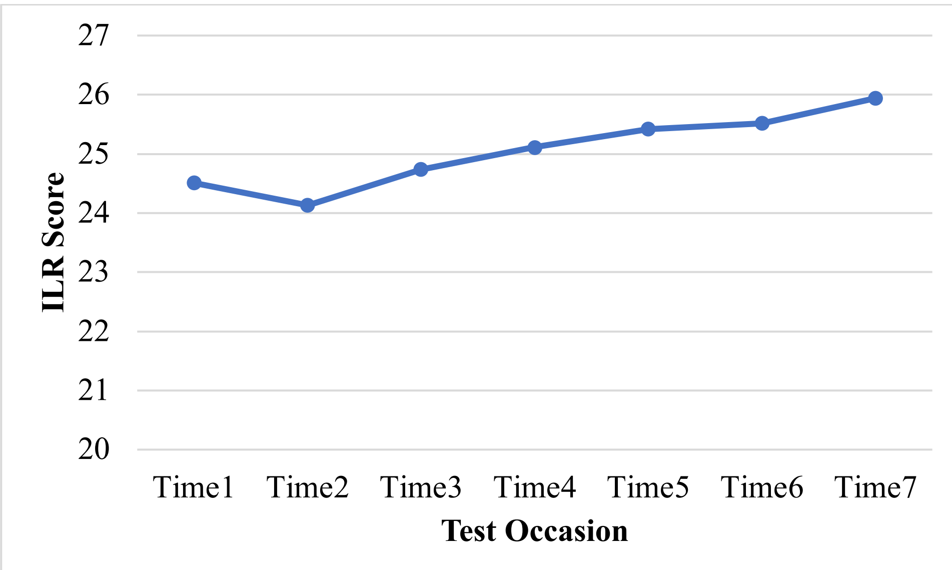
Table 5. DLPT Reading Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	7646	24.51	.052	4.513	20.363	-.651	.028	.463	.056
Time2	7646	24.13	.055	4.777	22.821	-.562	.028	-.087	.056

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time3	7646	24.74	.055	4.815	23.185	-.8	.028	.481	.056
Time4	5679	25.11	.061	4.613	21.276	-.833	.032	.457	.065
Time5	3697	25.42	.071	4.33	18.75	-.753	.04	-.082	.081
Time6	2115	25.52	.095	4.374	19.129	-1.028	.053	1.609	.106
Time7	1193	25.94	.121	4.162	17.325	-1.02	.071	.893	.142

Figure 10

Mean DLPT Reading Scores by Test Occasion

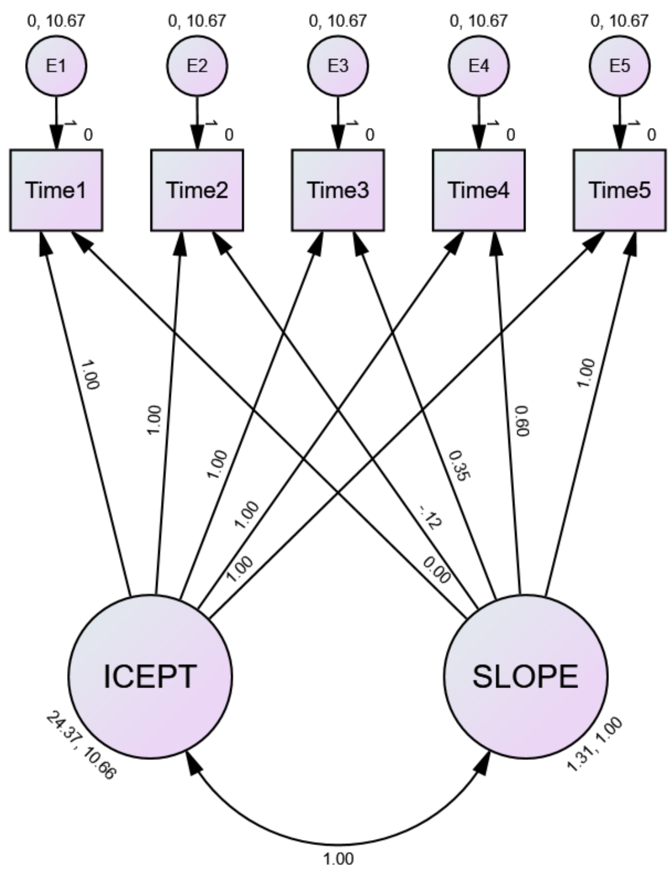


As with DLPT Listening, two growth models, linear and non-linear, were compared for DLPT Reading. The linear model, Model 2AA, assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 2A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 2A indicated a slightly better model fit (χ^2= 618.937*, df* = 13*, p* = .00; CFI = .940; RMSEA = .007, CI = .006-.007) than Model 2AA (χ^2= 713.227*, df* = 16*, p* = .00; CFI = .931; RMSEA = .006, CI = .006-.007). This was not surprising given the slight curve in Figure 10. Therefore, Model 2A was accepted as the base model.

The resulting path diagram is shown in Figure 11. The residual variances were all positive and significant (E1 = 10.670, *SE* = .098, CR = 109.344, $p < .001$; E2 = 10.670, *SE* = .098, CR = 109.344, $p < .001$; E3 = 10.670, *SE* = .098, CR = 109.344, $p < .001$; E4 = 10.670, *SE* = .098, CR = 109.344, $p < .001$; E5 = 10.670, *SE* = .098, CR = 109.344, $p < .001$). The mean slope was positive and significant ($M = 1.309$, $p < .001$) indicating that the DLPT reading scores increased slightly (given the small value) over time. The mean intercept was significant ($M = 24.367$, $p < .001$) indicating that the average initial score on the DLPT Reading was ILR Level 2 (20 – 25). The covariance between the slope and the intercept was set to 1.0. The slope variance had been set to 1.0 so that the model would converge. After running Model 2A initially, the slope variance was negative, indicating that the model did not converge. Therefore, the slope variance was set to a constant, 1.0. By extension, the covariance between the slope and the intercept also had to be set to a constant, 1.0. Therefore, instead of being freely estimated, these parameters were fixed. The intercept variance (10.662, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial DLPT Reading score.

Figure 11

Path Diagram DLPT Reading: Phase I Model 2A



DLI Language Difficulty Category I Results

The datasets for the previous analyses included all languages for each skill (Listening and Reading), so the previous base models (1A and 2A) provided insight into the overall language proficiency change for the entire Listening and Reading populations. The next step is to investigate the DLI Language Difficulty Categories separately; therefore, the next set of analyses used datasets that were separated according to the ILR Language Difficulty Categories. The first set of analyses examined all languages in DLI Language Difficulty Category I.

Listening

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for DLPT listening for DLI Difficulty Category I languages was 796 records. ILR ratings were converted to scores (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2+ = 26, 3 = 30). The descriptive statistics for the DLPT listening sample are shown in Table 6. 68.2% of the sample had four test occasions, 43.2% had five test occasions. Figure 12 displays the mean DLPT listening scores at each test occasion. The average listening proficiency stayed in the ILR level 2 range from test occasion one to five, indicating some but not a large amount of average growth. The average proficiency levels did increase overall. The *SDs* and variances indicate that there are between participant differences in scores and that the spread between participants decreases slightly from one test occasion to the next except between Time2 and Time3 where there is a slight increase. The skew and kurtosis values show that the distributions of listening scores at all test occasions are slightly negatively skewed and that for most test occasions the scores are slightly platykurtic.

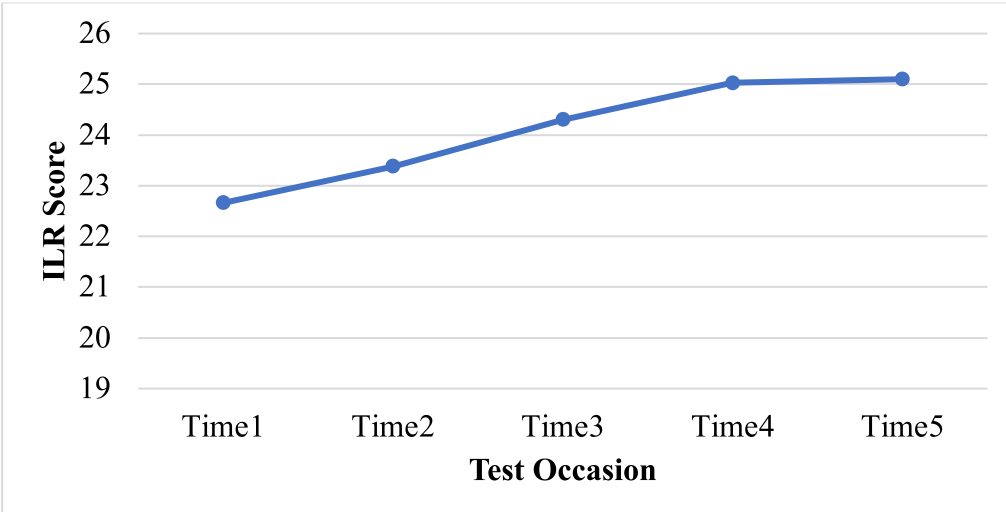
Table 6. DLI Language Difficulty Category I Descriptive Statistics: Listening

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
Time1	796	22.66	.186	5.240	27.462	-.139	.087	-.235	.173
Time2	796	23.38	.177	5.471	29.930	-.266	.024	-1.125	.173
Time3	796	24.30	.182	5.475	29.977	-.371	.024	-.728	.173
Time4	543	25.03	.207	5.275	27.830	-.396	.029	-.081	.209
Time5	344	25.10	.253	5.092	25.924	-.564	.037	-1.185	.262
APT*	796	109.97	.415	11.700	136.896	.884	.087	1.139	.173
COG*	796	88.78	.304	8.598	73.772	-1.141	.087	1.414	.173
ATT*	705	3.88	.035	.922	.850	-.260	.092	-.479	.184

***Descriptive statistics before standardization**

Figure 12

Mean DLPT Listening Scores by Test Occasion: DLI Language Difficulty Category I



As with the DLPT Listening and DLPT Reading analyses, two growth models, linear and non-linear were compared for DLI Language Difficulty Category I. The linear model, Model 3AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 3A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 3A indicated a better model fit (χ^2= 45.818, *df* = 11, *p* = .00; CFI = .976; RMSEA = .002, CI = .001-.002) than Model 3AA (χ^2= 74.688, *df* = 14 , *p* = .00; CFI = .959; RMSEA = .002, CI = .002-.003). This was not surprising given the slight curve in Figure 12. Therefore, Model 3A was accepted as the base model.

For Model 3A, the mean slope was positive and significant (*M* = 2.403, *p* < .001) indicating that the DLPT listening scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 22.527, *p* < .001) indicating that the average initial score on the DLPT Listening was ILR Level 2 (20 – 25). The significant negative covariance between the slope and the intercept (-3.895, $p < .001$) indicates that higher initial scores on the DLPT Listening were associated with lower rates of change and that lower initial scores on the DLPT Listening were associated with higher rates of change over time. The slope variance (7.103, $p < .001$) was significant indicating that there were significant inter-participant differences in language proficiency change over the five test occasions. The intercept variance (17.875, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial DLPT Listening score. Table 8 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: general cognitive ability (COG), language aptitude (APT), and attitude towards language learning (ATT). COG was entered into the model first due to the prediction, stemming from the existing literature, that general cognitive ability is the most likely to impact the intercept and slope of growth trajectories for those participants studying easier languages, in this case DLI Language Difficulty Category I (see Table 1). APT was entered into the model next due to the expectation, stemming from the existing literature, that it would also have an impact on the intercept and slope of the growth trajectories but not as much as COG for DLI Language Difficulty Category I languages. ATT was added to the model last. The model fit statistics for all models are listed in Table 7, the parameter statistics are listed in Table 8, and the standardized regression weights are listed in Table 9.

Table 7. DLI Language Difficulty Category I Model Fit Statistics: Listening

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
3A	Base	45.818	11	.000	.976	.002	.001 - .002
3B	3A + COG	53.224	14	.000	.974	.002	.001 - .002
3C	3B + APT	56.508	17	.000	.976	.002	.001 - .002
3D	3C + ATT	58.118	20	.000	.977	.001	.001 - .002

Table 8. DLI Language Difficulty Category I Parameter Statistics: Listening

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
3A	Base	22.527*	2.403*	17.875*	7.103*	-3.895*
3B	3A + COG	22.519*	2.400*	17.288*	7.134*	-3.776*
3C	3B + APT	22.512*	2.418*	16.706*	7.129*	-3.762*
3D	3C + ATT	22.511*	2.426*	16.671*	7.156*	-3.801*

*p < .001 **p < .05

Table 9. DLI Language Difficulty Category I Standardized Regression Weights: Listening

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
3B	Intercept	COG	.796	.176	4.523	< .001
	Slope	COG	-.225	.174	-1.292	.196
3C	Intercept	COG	.498	.186	2.673	.008**
	Slope	COG	-.207	.186	-1.109	.267
	Intercept	APT	.847	.193	4.401	< .001
	Slope	APT	-.036	.192	-.189	.850
3D	Intercept	COG	.488	.186	2.616	.009**
	Slope	COG	-.215	.187	-1.151	.250
	Intercept	APT	.869	.194	4.489	< .001
	Slope	APT	-.014	.194	-.071	.943
	Intercept	ATT	-.196	.185	-1.059	.290
	Slope	ATT	-.145	.185	-.782	.434

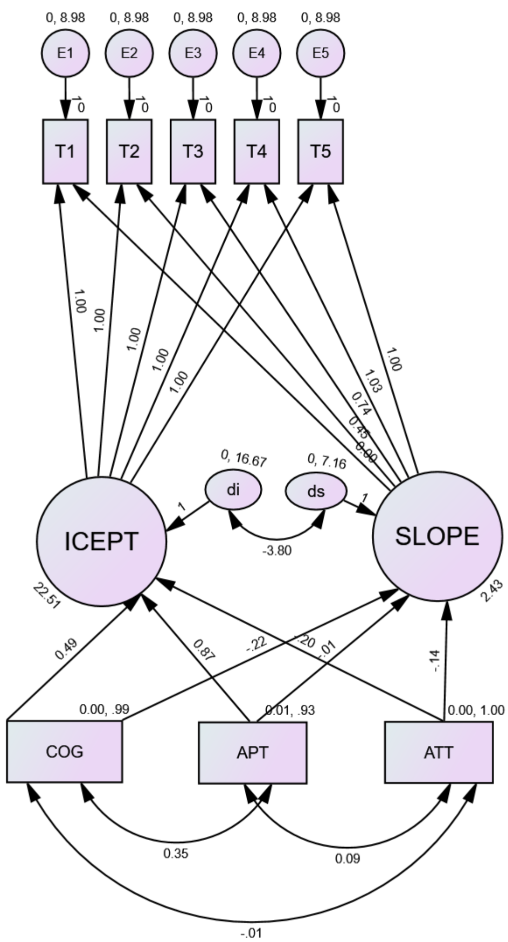
**p < .05

For the final model, Model 3D (Figure 13), the residual variances were all positive and significant (E1 = 8.975; *SE* = .304, CR = 29.523, $p < .001$; E2 = 8.975; *SE* = .304, CR = 29.523, $p < .001$; E3 = 8.975; *SE* = .304, CR = 29.523, $p < .001$; E4 = 8.975; *SE* = .304, CR = 29.523, $p < .001$; E5 = 8.975; *SE* = .304, CR = 29.523, $p < .001$). Both COG and APT were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial DLPT Listening scores for participants in DLI Language Difficulty Category I languages. The covariance between COG and APT is also significant, so even though the prediction value of COG on the intercept decreases from one model to the next (see Table 9) this is likely due to

APT being entered into the models. Interestingly, APT was a stronger predictor than COG. This goes against the prediction that COG would have more predictive value for Cat I languages. ATT was not a significant predictor of the intercept and none of the predictors were significant predictors of the slope. This may be because although the slope was significant, there was a limited amount of growth in the DLI Language Difficulty Category I DLPT Listening population.

Figure 13

Path Diagram DLI Language Difficulty Category I Listening: Phase I Model 3D



Reading

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for DLPT reading for DLI Language Difficulty Category I languages was 805 records. ILR ratings were converted to scores (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2+ = 26, 3 = 30). The descriptive statistics for the DLPT reading sample are shown in Table 10. 67.6% of the sample had four test occasions, 42.2% had five test occasions. Figure 14 displays the mean DLPT reading scores at each test occasion. The average reading proficiency stayed in the ILR level 2 range from test occasion one to four and approached ILR level 2+ by test occasion 5, indicating some average growth. The average proficiency levels did increase overall. The *SDs* and variances indicate that there are between participant differences in scores and that the spread between participants decreases slightly from one test occasion to the next. The skew and kurtosis values show that the distributions of reading scores at all test occasions are slightly negatively skewed and that for most test occasions the scores are slightly platykurtic.

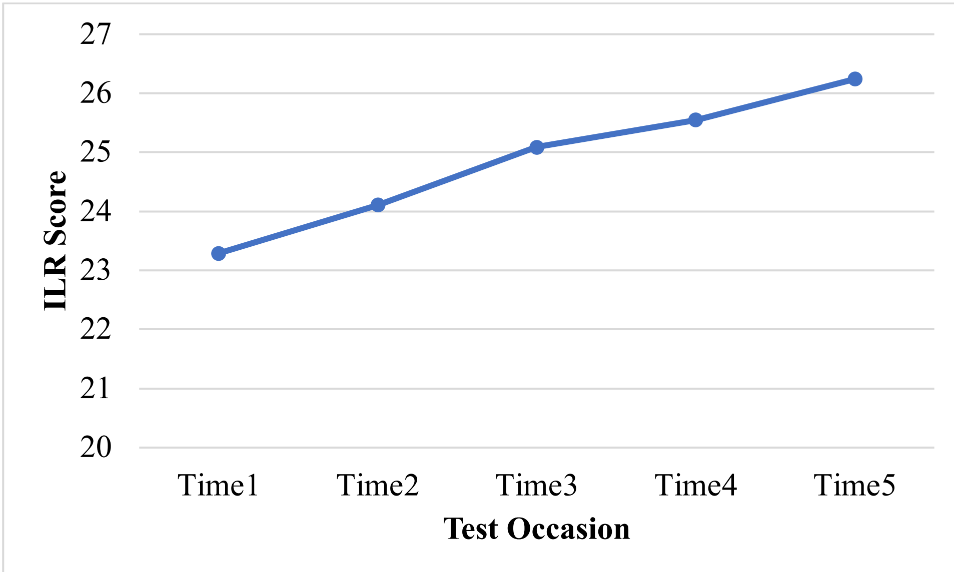
Table 10. DLI Language Difficulty Category I Descriptive Statistics: Reading

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
Time1	805	23.29	.172	4.889	23.901	-.287	.086	.080	.172
Time2	805	24.11	.170	4.832	23.351	-.362	.086	-.540	.172
Time3	805	25.09	.169	4.785	22.894	-.486	.086	-.927	.172
Time4	544	25.55	.192	4.469	19.972	-.693	.105	-.238	.209
Time5	340	26.24	.220	4.053	16.425	-.758	.132	-.453	.264
APT*	805	110.05	.409	8.745	134.730	.908	.086	1.111	.172
COG*	805	88.68	.308	11.607	76.468	-1.167	.086	1.444	.172
ATT*	713	3.88	.034	.920	.847	-.252	.092	-.482	.183

***Descriptive statistics before standardization*

Figure 14

Mean DLPT Reading Scores by Test Occasion: DLI Language Difficulty Category I



Two growth models, linear and non-linear were compared. The linear model, Model 4AA, assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 4A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. The model fit for Model 4AA (χ^2= 97.011, df = 16, p = .00; CFI = .930; RMSEA = .002, CI = .002-.003) and Model 4A (χ^2= 93.550, df = 13, p = .00; CFI = .930; RMSEA = .002, CI = .002-.003) was almost the same, so Model 4AA, the linear model, was accepted as the base model.

For Model 4AA, the mean slope was positive and significant (M = 3.178, p < .001) indicating that the DLPT listening scores increased over time. The mean intercept was significant (M = 23.342, p < .001) indicating that the average initial score on the DLPT Reading was ILR Level 2 (20 – 25). After running Model 4AA initially, the slope variance was negative, indicating that the model did not converge. Therefore, the slope variance was set to a constant, 1.0. By extension, the covariance between the slope and the intercept also had to be set to a constant, 1.0. Therefore, instead of being freely estimated, these parameters were fixed. While this does prohibit an examination of the slope variance and slope and intercept covariance, fixing the slope variance and slope and intercept variance does not impact the interpretation of the regression weights of the predictors on the slope mean. The intercept variance (11.454, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial DLPT Reading score. Table 12 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the linear base model one at a time in the same order that was used for the DLPT Listening dataset (COG, APT, then ATT). The model fit statistics for all models are listed in Table 11, the parameter statistics are listed in Table 12, and the standardized regression weights are listed in Table 13.

Table 11. DLI Language Difficulty Category I Model Fit Statistics: Reading

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
4AA	Base	97.011	15	.000	.930	.002	.002 - .003
4B	4AA +COG	97.464	19	.000	.937	.002	.002 - .002
4C	4AA + APT	98.861	22	.000	.945	.002	.001 - .002
4D	4B + ATT	100.846	25	.000	.946	.002	.001 - .002

Table 12. DLI Language Difficulty Category I Parameter Statistics: Reading

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope (S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
4AA	Base	23.342*	3.178*	11.454*	1.0	1.0
4B	4AA + COG	23.342*	3.175*	9.812*	1.0	1.0
4C	4B + APT	23.342*	3.177*	9.039*	1.0	1.0
4D	4C + ATT	23.342*	3.180*	9.041*	1.0	1.0

*p < .001 **p < .05

Table 13. DLI Language Difficulty Category I Standardized Regression Weights: Reading

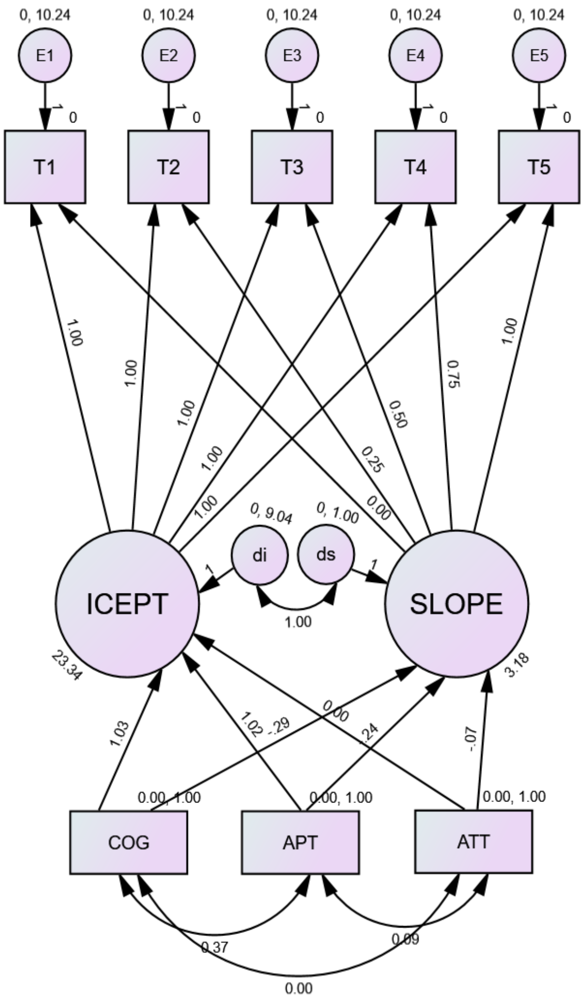
Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
4B	Intercept	COG	1.408	.143	9.848	< .001
	Slope	COG	-.378	.186	-2.035	.042**
4C	Intercept	COG	1.033	.150	6.889	< .001
	Slope	COG	-.286	.199	-1.434	.151
	Intercept	APT	1.026	.150	6.839	< .001
	Slope	APT	-.246	.199	-1.237	.216
4D	Intercept	COG	1.033	.150	6.885	< .001
	Slope	COG	-.289	.199	-1.449	.147
	Intercept	APT	1.025	.151	6.798	< .001
	Slope	APT	-.237	.200	-1.183	.237
	Intercept	ATT	.004	.149	.024	.981
	Slope	ATT	-.070	.198	-.352	.725

**p < .05

For the final model, Model 4D (Figure 15), the residual variances were all positive and significant (E1 = 10.242; *SE* = .293, CR = 34.987, $p < .001$; E2 = 10.242; *SE* = .293, CR = 34.987, $p < .001$; E3 = 10.242; *SE* = .293, CR = 34.987, $p < .001$; E4 = 10.242; *SE* = .293, CR = 34.987, $p < .001$; E5 = 10.242; *SE* = .293, CR = 34.987, $p < .001$). Both COG and APT were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial DLPT Reading scores for participants in DLI Language Difficulty Category I languages. The covariance between COG and APT is also significant, so even though the prediction value of COG on the intercept decreases from one model to the next (see Table 14) this is likely due to APT being entered into the models. ATT was not a significant predictor of the intercept. COG was a significant predictor of the slope in Model 4B; however, once APT was entered into the model (4C) it was no longer a significant predictor of the slope. The other predictors were not predictors of the slope. This may be because although the slope was significant, there was a limited amount of growth in the ILR Difficulty Category I DLPT Reading population.

Figure 15

Path Diagram DLI Language Difficulty Category I Reading: Phase I Model 4D



DLI Language Difficulty Category III Results

Listening

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for DLPT listening for DLI Language Difficulty Category III languages was 2764 records. ILR ratings were converted to scores (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2+ = 26, 3 = 30). The descriptive statistics for the DLPT listening sample are shown in Table 14. 75.1% of the sample had four test occasions; 50.9% had five test occasions. Figure

16 displays the mean DLPT listening scores at each test occasion. The average listening proficiency stayed in the ILR level 2 range from test occasion one to five, indicating some but not a large amount of average growth. The average proficiency levels did increase overall. The *SDs* and variances indicate that there are between participant differences in scores and that the spread between participants decreases slightly from one test occasion to the next except between Time2 and Time3 where there is a slight increase. The skew and kurtosis values show that the distributions of listening scores at all test occasions are slightly negatively skewed and that for most test occasions the scores are slightly platykurtic.

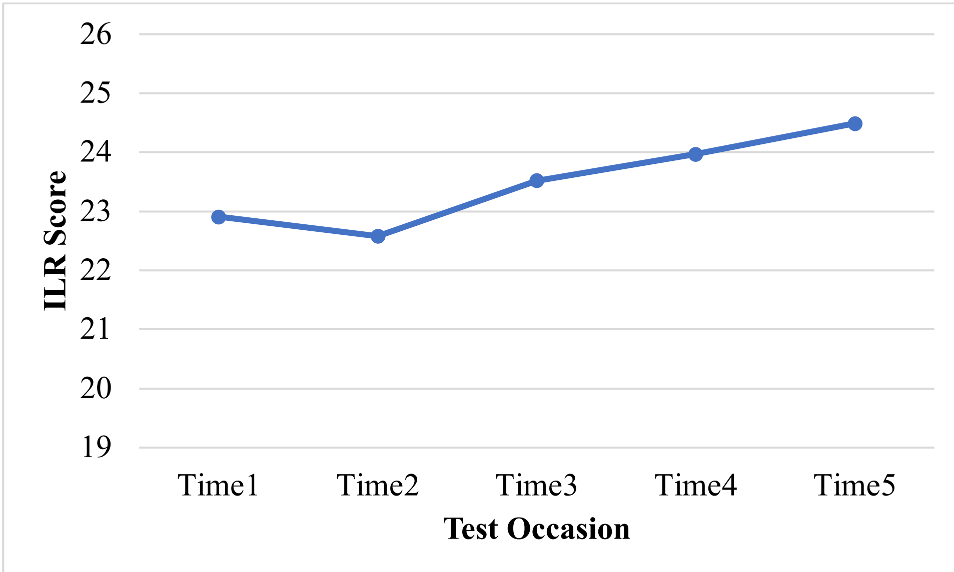
Table 14. DLI Language Difficulty Category III Descriptive Statistics: Listening

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	2764	22.91	.095	4.979	24.790	-.389	.047	.039	.093
Time2	2764	22.58	.098	5.147	26.487	-.333	.047	-.358	.093
Time3	2764	23.52	.098	5.143	26.452	-.530	.047	-.252	.093
Time4	2075	23.97	.109	4.956	24.566	-.523	.054	-.408	.107
Time5	1407	24.49	.124	4.664	21.752	-.663	.065	-.058	.130
APT*	2764	113.18	.203	10.654	113.502	.845	.047	.886	.093
COG*	2764	89.99	.156	8.187	67.030	-1.297	.047	1.752	.093
ATT*	2416	3.75	.020	.974	.949	-.298	.050	-.156	.100

Descriptive statistics before standardization

Figure 16

Mean DLPT Listening Scores by Test Occasion: DLI Language Difficulty Category III



As with the previous analyses in Phase I, two growth models, linear and non-linear were compared for DLI Language Difficulty Category III Listening. The linear model, Model 5AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 5A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 5A indicated a better model fit (χ^2= 124.919, *df* = 11, *p* = .00; CFI = .971; RMSEA = .003, CI = .003-.004) than Model 5AA (χ^2= 175.127, *df* = 14, *p* = .00; CFI = .944; RMSEA = .003, CI = .003-.004). This was not surprising given the slight curve in Figure 10. Therefore, Model 5A was accepted as the base model.

For Model 5A, the mean slope was positive and significant (*M* = 1.573, *p* < .001) indicating that the DLPT listening scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 22.893, *p* < .001) indicating that the average initial score on the DLPT Listening was ILR Level 2 (20 – 25). The covariance between the slope and the intercept was positive but not significant (.019, p >.05). The slope variance (1.458, $p < .05$) was significant indicating that there were significant inter-participant differences in language proficiency change over the five test occasions. The intercept variance (13.576, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial DLPT Listening score. Table 16 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT). APT was entered into the model first due to the prediction, stemming from the existing literature, that language aptitude is the most likely to impact the intercept and slope of growth trajectories for those participants studying more difficult languages, in this case DLI Language Difficulty Category III (see Table 1). COG was entered into the model next due to the expectation, stemming from the existing literature, that general cognitive ability would also have an impact on the intercept and slope of the growth trajectories but not as much as APT for DLI Language Difficulty Category III languages. ATT was added to the model last. The model fit statistics for all models are listed in Table 15, the parameter statistics are listed in Table 16, and the standardized regression weights are listed in Table 17.

Table 15. DLI Language Difficulty Category III Model Fit Statistics: Listening

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
5A	Base	124.92	11	.000	.971	.003	.003 - .004
5B	5A + APT	125.49	14	.000	.972	.002	.002 - .003
5C	5B + COG	130.05	17	.000	.975	.003	.002 - .003
5D	5C + ATT	135.90	20	.000	.974	.002	.002 - .003

Table 16. DLI Language Difficulty Category III Parameter Statistics: Listening

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
5A	Base	22.893*	1.563*	13.576*	1.458*	.019
5B	5A + APT	22.893*	1.577*	13.255*	1.470**	-.067
5C	5B + COG	22.888*	1.572*	12.994*	1.510*	-.155
5D	5C + ATT	22.874*	1.598*	12.989*	1.476**	-.159

*p < .001 **p < .05

Table 17. DLI Language Difficulty Category III Standardized Regression Weights: Listening

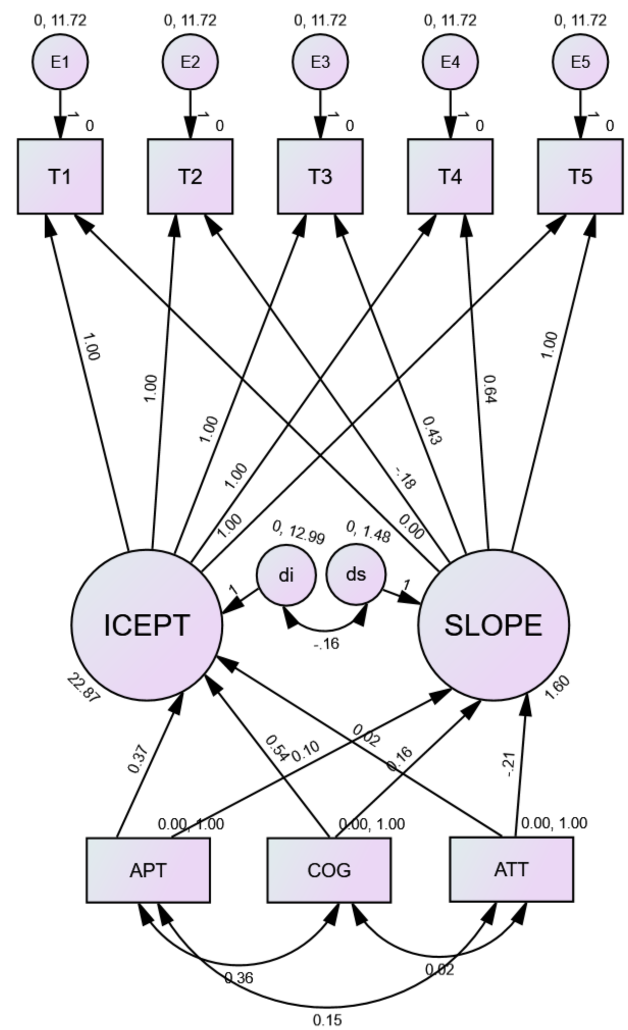
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
5B	Intercept	APT	.568	.079	7.159	< .001
	Slope	APT	.115	.086	1.342	.180
5C	Intercept	APT	.374	.084	4.433	< .001
	Slope	APT	.060	.092	.652	.514
	Intercept	COG	.545	.084	6.461	< .001
	Slope	COG	.163	.092	1.772	.076
5D	Intercept	APT	.370	.086	4.324	< .001
	Slope	APT	.095	.094	1.018	.309
	Intercept	COG	.544	.085	6.426	< .001
	Slope	COG	.158	.093	1.706	.088
	Intercept	ATT	.016	.086	.186	.853
	Slope	ATT	-.212	.094	-2.255	.024**

**p < .05

For the final model, Model 5D (Figure 17), the residual variances were all positive and significant (E1 = 11.719; *SE* = .201, CR = 58.308, $p < .001$; E2 = 11.719; *SE* = .201, CR = 58.308, $p < .001$; E3 = 11.719; *SE* = .201, CR = 58.308, $p < .001$; E4 = 11.719; *SE* = .201, CR = 58.308, $p < .001$; E5 = 11.719; *SE* = .201, CR = 58.308, $p < .001$). Both APT and COG were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial DLPT Listening scores for participants in DLI Language Difficulty Category III languages. The covariance between COG and APT is also significant, so even though the prediction value of APT on the intercept decreases from one model to the next (see Table 9) this is likely due to COG being entered into the models. Interestingly, COG was a stronger predictor than APT. This goes against the prediction that APT would have more predictive value for DLI Language Difficulty Category III languages. ATT was not a significant predictor of the intercept; however, it was a predictor of the slope. The value is negative and small; this suggests that those participants with lower levels of attitude (more unfavorable) towards learning their assigned language experienced more language proficiency growth over time. This finding should be taken lightly though as the measure indicated attitude at one point in time (at the beginning of the participants' studies at DLIFLC). The other predictors were not significant predictors of the slope. This may be because although the mean slope was significant, there was a limited amount of growth in the DLI Language Difficulty Category III DLPT Listening population. The covariance between APT and ATT was also significant and positive, indicating a positive relationship between language aptitude and attitude towards learning assigned language. This may be because those who have higher degrees of language aptitude find learning languages to be easier. This would likely impact their attitude towards learning a language.

Figure 17

Path Diagram DLI Language Difficulty Category III Listening: Phase I Model 5D



Reading

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for DLI Language Difficulty Category III DLPT reading was 2761 records. ILR ratings were converted to scores (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2+ = 26, 3 = 30). The descriptive statistics for the DLPT reading sample are shown in Table 18. 75.2% of the sample had four test occasions, 50.7% had five test occasions. Figure 18 displays the mean

DLPT reading scores at each test occasion. The average reading proficiency stayed in the ILR level 2 range from test occasion one to five, indicating limited growth. The average proficiency levels did increase overall. The *SDs* and variances indicate that there are between participant differences in scores and that the spread between participants increases slightly between test occasions 1 and 2 and then decreases slightly from one test occasion to the next. The skew and kurtosis values show that the distributions of reading scores at all test occasions are slightly negatively skewed and that for most test occasions the scores are slightly platykurtic.

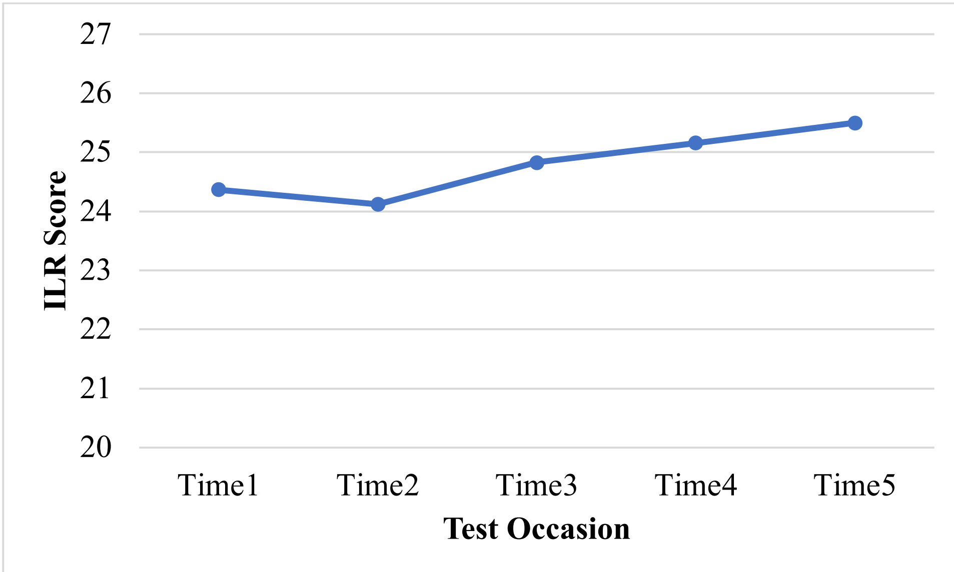
Table 18. DLI Language Difficulty Category III Descriptive Statistics: Reading

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
Time1	2761	24.37	.085	4.450	19.802	-.556	.047	.301	.093
Time2	2761	24.12	.087	4.559	20.783	-.322	.047	-.715	.093
Time3	2761	24.83	.086	4.495	20.203	-.559	.047	-.495	.093
Time4	2075	25.16	.097	4.430	19.629	-.656	.054	-.269	.107
Time5	1401	25.50	.111	4.146	17.186	-.655	.065	-.484	.131
APT*	2761	113.19	.203	10.673	113.914	.841	.047	.866	.093
COG*	2761	90.01	.155	8.165	66.668	-1.303	.047	1.785	.093
ATT*	2414	3.75	.020	.976	.953	-.301	.050	-.152	.100

Descriptive statistics before standardization

Figure 18

Mean DLPT Reading Scores by Test Occasion: DLI Language Difficulty Category III



As with previous analyses from Phase I, two growth models, linear and non-linear were compared for DLI Language Difficulty Category III Reading. The linear model, Model 6AA, assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 6A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 6A indicated a better model fit (χ^2= 172.434, df = 11 , p = .00; CFI = .963; RMSEA = .004, CI = .003-.004) than Model 6AA (χ^2= 216.342, df = 14 , p = .00; CFI = .954; RMSEA = .004, CI = .003-.004). Model 6A was accepted as the base model.

For Model 6A, the mean slope was positive and significant ($M = 1.561$, $p < .001$) indicating that the DLPT reading scores increased over time. The mean intercept was significant ($M = 24.330$, $p < .001$) indicating that the average initial score on the DLPT reading was ILR Level 2 (20 – 25). The significant negative covariance between the slope and the intercept (-.558, $p <$

.001) indicates that higher initial scores on the DLPT reading were associated with lower rates of change and that lower initial scores on the DLPT reading were associated with higher rates of change over time. The slope variance (1.098, $p < .05$) was significant indicating that there were significant inter-participant differences in language proficiency change over the five test occasions. The intercept variance (11.310, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial DLPT reading score. Table 20 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the same order as they were for the DLPT Listening dataset (APT, COG, and then ATT). The model fit statistics for all models are listed in Table 19, the parameter statistics are listed in Table 20, and the standardized regression weights are listed in Table 21.

Table 19. DLI Language Difficulty Category III Model Fit Statistics: Reading

Model	*Model Variables*	χ^2	*df*	*p*	CFI	RMSEA	CI
6A	Base	172.434	11	.000	.963	.004	.003 - .004
6B	6A +APT	174.747	14	.000	.964	.003	.003 - .004
6C	6B + COG	180.455	17	.000	.967	.003	.003 - .003
6D	6C + ATT	186.933	21	.000	.967	.003	.002 - .003

Table 20. DLI Language Difficulty Category III Parameter Statistics: Reading

Model	***Model Variables***	**Intercept (I) *M***	**Slope (S) *M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
6A	Base	24.330*	1.561*	11.310*	1.098**	-.558*
6B	6A + APT	24.330*	1.566	10.816*	1.098**	-.547
6C	6B + COG	24.332*	1.563*	10.295*	1.077**	-.566
6D	6C + ATT	24.335*	1.560*	10.284*	1.00	-.544**

*p < .001 **p < .05

Table 21. DLI Language Difficulty Category III Standardized Regression Weights: Reading

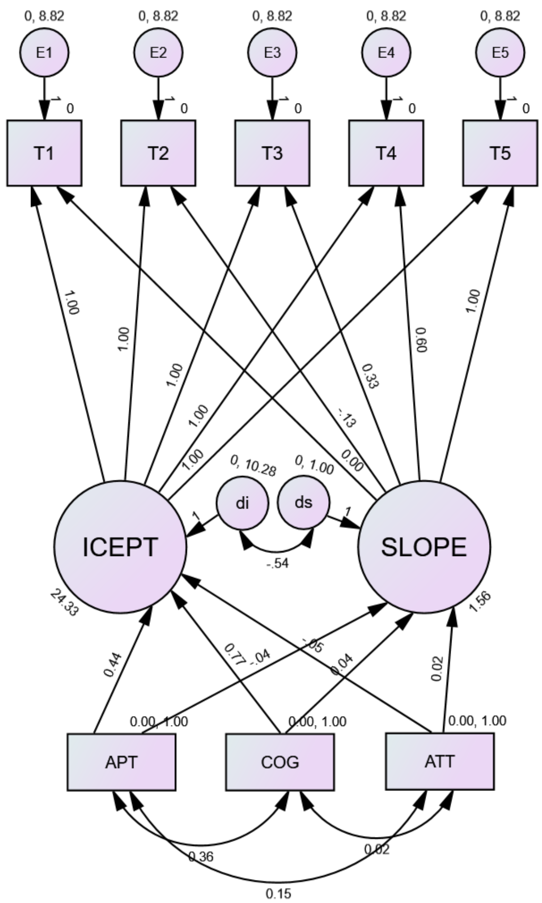
Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
6B	Intercept	APT	.703	.071	9.860	<.001
	Slope	APT	-.028	.080	-.350	.720
6C	Intercept	APT	.428	.075	5.715	<.001
	Slope	APT	-.038	.086	-.444	.657
	Intercept	COG	.771	.075	10.295	<.001
	Slope	COG	.036	.086	.421	.674
6D	Intercept	APT	.435	.076	5.745	<.001
	Slope	APT	-.042	.087	-.484	.628
	Intercept	COG	.769	.075	10.272	<.001
	Slope	COG	.037	.086	.431	.667
	Intercept	ATT	-.046	.076	-.612	.541
	Slope	ATT	.020	.086	.228	.819

**$p < .05$

For the final model, Model 6D (Figure 19), the residual variances were all positive and significant (E1 = 8.82; *SE* = .134, CR = 65.718, $p < .001$; E2 = 8.82; *SE* = .134, CR = 65.718, $p < .001$; E3 = 8.82; *SE* = .134, CR = 65.718, $p < .001$; E4 = 8.82; *SE* = .134, CR = 65.718, $p < .001$; E5 = 8.82; *SE* = .134, CR = 65.718, $p < .001$). Both COG and APT were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial DLPT Reading scores for participants in Category III languages. The covariance between COG and APT is also significant, so even though the prediction value of APT on the intercept decreases from one model to the next (see Table 24), this is likely due to COG being entered into the models. The covariance between APT and ATT was marginally significant ($p = .047$), and the covariance was negative (-.544), implying an inverse relationship. ATT was not a significant predictor of the intercept. None of the predictors were significant predictors of the slope. This may be because although the slope was significant, there was a limited amount of growth in the DLI Language Difficulty Category III DLPT reading population.

Figure 19

Path Diagram DLI Language Difficulty Category III Reading: Phase I Model 6D



DLI Language Difficulty Category IV Results

Listening

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for DLPT listening for DLI Language Difficulty Category IV languages was 6106 records. ILR ratings were converted to scores (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2+ = 26, 3 = 30). The descriptive statistics for the DLPT listening sample are shown in Table 22. 69.2% of the sample had four test occasions; 42.1% had five test occasions. Figure 20 displays the mean DLPT listening scores at each test occasion. The average listening proficiency stayed in the ILR level 2 range from test occasion one to five, indicating some but not a large amount of average growth. The average proficiency levels did increase overall. The *SDs* and variances indicate that there are between participant differences in scores and that the spread between participants decreases slightly from one test occasion to the next. The skew and kurtosis values show that the distributions of listening scores at all test occasions are slightly negatively skewed and that for most test occasions the scores are slightly platykurtic.

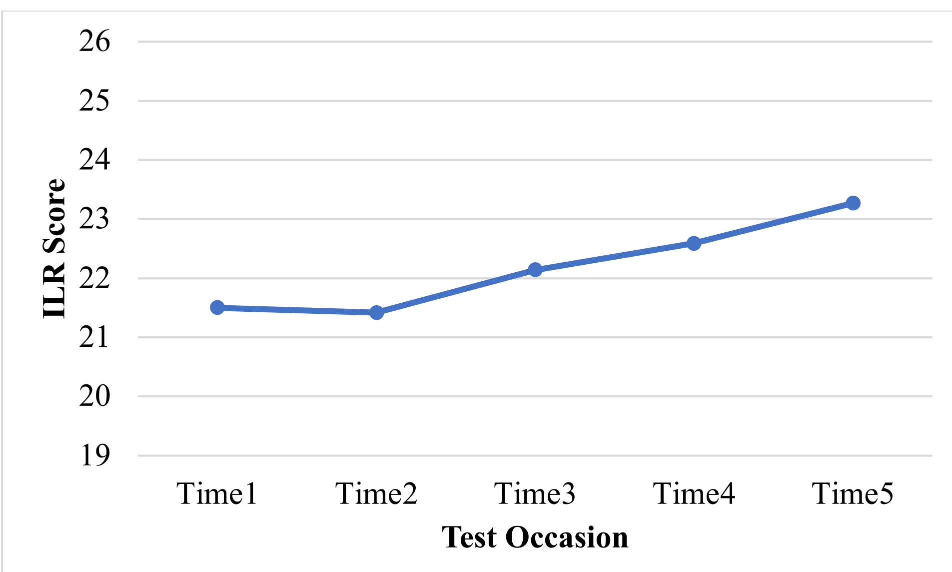
Table 22. DLI Language Difficulty Category IV Descriptive Statistics: Listening

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	6106	21.50	.075	5.845	34.162	-.355	.031	-.070	.063
Time2	6106	21.42	.073	5.687	32.338	-.295	.031	-.093	.063
Time3	6106	22.14	.072	5.639	31.803	-.348	.031	-.225	.063
Time4	6106	22.59	.083	5.411	29.280	-.351	.038	-.223	.075
Time5	2571	23.27	.105	5.300	28.090	-.525	.048	.121	.097
APT*	6106	121.78	.140	10.960	10.960	.244	.031	-.158	.063
COG*	6106	92.57	.086	6.704	44.942	-1.436	.031	1.995	.063
ATT*	4779	3.89	.014	.973	.947	-.440	.035	-.222	.071

***Descriptive statistics before standardization**

Figure 20

Mean DLPT Listening Scores by Test Occasion: DLI Language Difficulty Category IV



Two growth models, linear and non-linear were compared. The linear model, Model 7AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 7A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 7A indicated a better model fit (χ^2= 294.153, *df* = 11, *p* = .00; CFI = .973; RMSEA = .005, CI = .004-.005) than Model 7AA (χ^2= 344.685, *df* = 14, *p* = .00; CFI = .969; RMSEA = .005, CI = .004-.005). This was not surprising given the slight curve in Figure 21. Therefore, Model 7A was accepted as the base model.

For Model 7A, the mean slope was positive and significant (*M* = 1.766, *p* < .001) indicating that the DLPT listening scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 21.464, *p* < .001) indicating that the average initial score on the DLPT Listening was ILR Level 2 (20 – 25). The covariance between the slope and the intercept was negative and significant (-1.845, *p* <.001) indicating that higher initial scores on the DLPT Listening were associated with lower rates of change and that lower initial scores on the DLPT Listening were associated with higher rates of change over time. The slope variance (2.051, *p* < .05) was significant indicating that there were significant inter-participant differences in language proficiency change over the five test occasions. The intercept variance (19.806, *p* < .001) was significant indicating that there were significant inter-participant differences on the initial DLPT Listening score. Table 24 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT). APT was entered into the model first due to the prediction, stemming from the existing literature, that language aptitude is the most likely to impact the intercept and slope of growth trajectories for those participants studying more difficult languages, in this case Category IV (see Table 1). COG was entered into the model next due to the expectation, stemming from the existing literature, that general cognitive ability would also have an impact on the intercept and slope of the growth trajectories but not as much as APT for Category IV languages. ATT was added to the model last. The model fit statistics for all models are listed in Table 23, the parameter statistics are listed in Table 24, and the standardized regression weights are listed in Table 25. The descriptive statistics for the predictors are listed in Table 22.

Table 23. DLI Language Difficulty Category IV Model Fit Statistics: Listening

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
7A	Base	294.153	11	.000	.973	.005	.004 -.005
7B	7A + APT	294.074	14	.000	.974	.004	.004 -.005
7C	7B + COG	295.353	17	.000	.976	.004	.004 - .004
7D	7C + ATT	296.560	20	.000	.977	.004	.003- .004

Table 24. DLI Language Difficulty Category IV Parameter Statistics: Listening

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope (S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
7A	Base	21.464*	1.766*	19.806*	2.051*	-1.845*
7B	7A + APT	21.465*	1.771*	19.392*	2.037*	-1.840*
7C	7B + COG	21.464*	1.772*	19.355*	2.045*	-1.858*
7D	7C + ATT	21.466*	1.777*	19.344*	2.001*	-1.840*

*p < .001 **p < .05

Table 25. DLI Language Difficulty Category IV Standardized Regression Weights: Listening

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
7B	Intercept	APT	.642	.064	10.041	< .001
	Slope	APT	-.009	.075	-.114	.909
7C	Intercept	APT	.555	.070	7.966	< .001
	Slope	APT	-.036	.082	-.442	.658
	Intercept	COG	.217	.070	3.111	.002

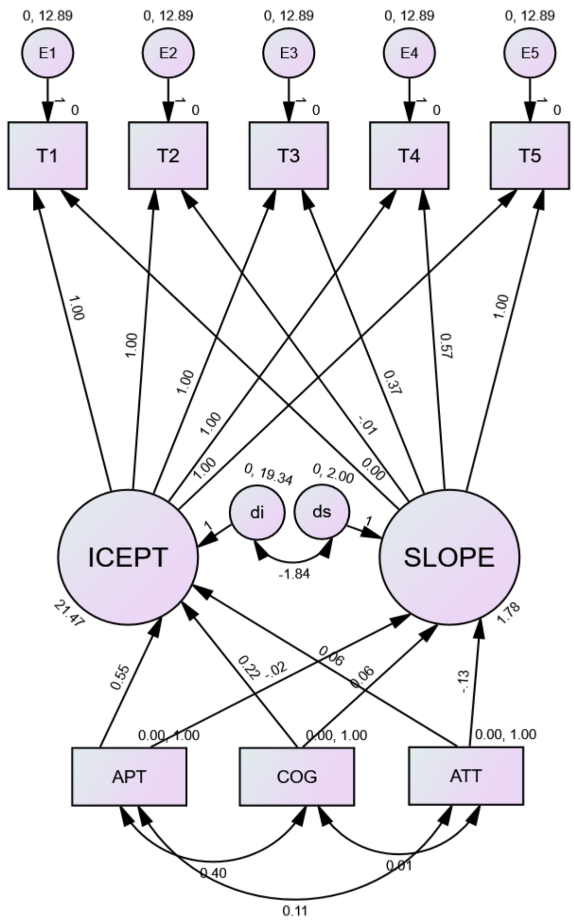
	Slope	COG	.067	.082	.819	.413
7D	Intercept	APT	.548	.070	7.794	< .001
	Slope	APT	-.018	.083	-.217	.828
	Intercept	COG	.219	.070	3.143	.002
	Slope	COG	.063	.082	.765	.444
	Intercept	ATT	.059	.073	.805	.421
	Slope	ATT	-.133	.085	-1.570	.116

**p < .05

For the final model, 7D, (Figure 21), all residual variances were positive and significant (E1 = 12.890; *SE* = .149; CR = 86.261, $p < .001$; E2 = 12.890; *SE* = .149; CR = 86.261, $p < .001$; E3 = 12.890; *SE* = .149; CR = 86.261, $p < .001$; E4 = 12.890; *SE* = .149; CR = 86.261, $p < .001$; E5 = 12.890; *SE* = .149; CR = 86.261, $p < .001$). Both APT and COG were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial DLPT Listening scores for participants in DLI Language Difficulty Category IV languages. The covariance between COG and APT is also significant, so even though the prediction value of APT on the intercept decreases from one model to the next (see Table 25) this is likely due to COG being entered into the models. APT was a stronger predictor than COG; this result aligns with the prediction that APT would have more predictive value for DLI Language Difficulty Category IV languages. ATT was not a significant predictor of the intercept or slope. The other predictors were not significant predictors of the slope. This may be because although the mean slope was significant, there was a limited amount of growth in the DLI Language Difficulty Category IV DLPT Listening population. The covariance between APT and ATT was also significant and positive, indicating a positive relationship between language aptitude and attitude towards learning assigned language. This may be because those who have higher degrees of language aptitude find learning languages to be easier. This would likely impact their attitude towards learning a language.

Figure 21

Path Diagram DLI Language Difficulty Category IV Listening: Phase I Model 7D



Reading

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for DLPT reading was 3973 records. ILR ratings were converted to scores (0 = 0, 0+ = 6, 1 = 10, 1+ = 16, 2 = 20, 2+ = 26, 3 = 30). The descriptive statistics for the DLPT reading sample are shown in Table 26. 75.73% of the sample had four test occasions, and 48.78% had five test occasions. Figure 22 displays the mean DLPT reading scores at each test occasion. The average reading proficiency stayed in the ILR level 2 range from test occasion one to five, indicating limited growth. The average proficiency levels did increase overall but not by much. There was a dip in mean scores between test occasions 1 and 2 and at test occasion 3 the mean score was lower than that at test occasion 1. The *SDs* and variances indicate that there are between participant differences in scores and that the spread between participants increases slightly between test occasions 1 and 2 and then decreases slightly from one test occasion to the next. The skew and kurtosis values show that the distributions of reading scores at all test occasions are slightly negatively skewed and that for most test occasions the scores are slightly leptokurtic.

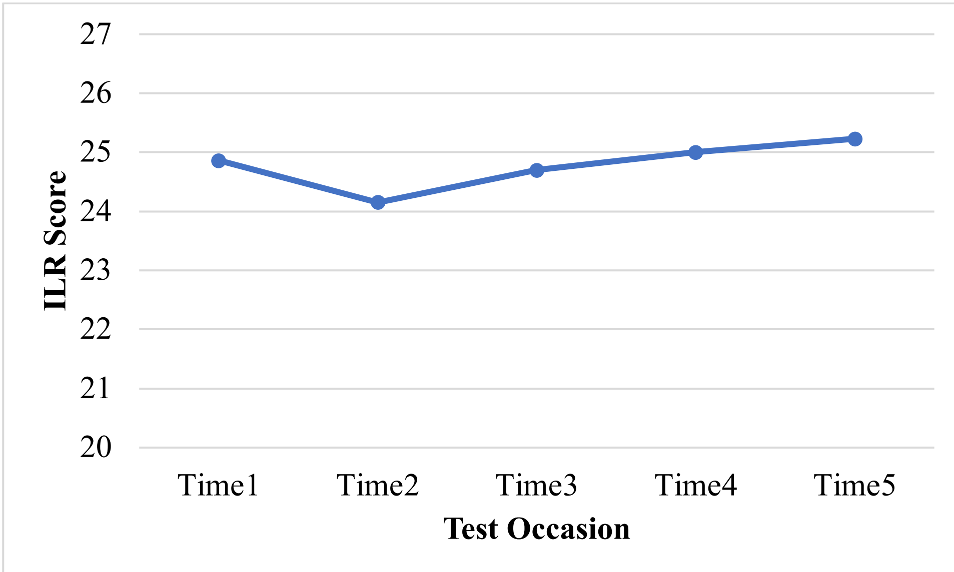
Table 26. DLI Language Difficulty Category IV Descriptive Statistics: Reading

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
Time1	3973	24.86	.070	4.422	19.558	-.788	.039	.781	.078
Time2	3973	24.15	.077	4.885	23.860	-.710	.039	.246	.078
Time3	3973	24.70	.077	4.828	23.308	-.781	.039	.236	.078
Time4	3009	25.00	.086	4.720	22.282	-.893	.045	.598	.089
Time5	1938	25.23	.102	4.488	20.138	-.800	.056	.116	.111
APT*	3973	121.63	.172	10.850	117.727	.248	.039	-.124	.078
COG*	3973	92.47	.109	6.896	47.548	-1.463	.039	2.066	.078
ATT*	3290	3.90	.017	.981	.962	-.442	.043	-.268	.085

**Descriptive statistics before standardization*

Figure 22

Mean DLPT Reading Scores by Test Occasion: DLI Language Difficulty Category IV



Two growth models, linear and non-linear were compared. The linear model, Model 8AA, assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 8A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 8A indicated a better model fit (χ^2= 327.420, df = 11, p = .000; CFI = .932; RMSEA = .005, CI = .005-.006) than Model 8AA (χ^2= 453.260, df = 14, p = .000; CFI = .906; RMSEA = .006, CI = .005-.006). Model 8A was accepted as the base model.

For Model 8A, the mean slope was negative and significant (M = -.225, p < .001) indicating that the DLPT reading scores decreased slightly over time. The mean intercept was significant (M = 25.080, p < .001) indicating that the average initial score on the DLPT reading was ILR Level 2 (20 – 25). The negative covariance between the slope and the intercept (-.180) was not significant (p > .05). The slope variance (.729, p < .05) was significant indicating that there were significant inter-participant differences in language proficiency change over the five test occasions. The intercept variance (9.516, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial DLPT reading score. Table 28 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the same order as they were for the DLPT Listening dataset (APT, COG, and then ATT). The model fit statistics for all models are listed in Table 27, the parameter statistics are listed in Table 28, and the standardized regression weights are listed in Table 29.

Table 27. DLI Language Difficulty Category IV Model Fit Statistics: Reading

Model	*Model Variables*	χ^2	*df*	*p*	CFI	RMSEA	CI
8A	Base	327.420	11	.000	.932	.005	.005 - .006
8B	8A + APT	336.791	14	.000	.934	.005	.004 - .005
8C	8B + COG	347.526	17	.000	.941	.004	.004 - .005
8D	8C + ATT	354.704	20	.000	.941	.004	.004 - .004

Table 28. DLI Language Difficulty Category IV Parameter Statistics: Reading

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
8A	Base	25.080*	-.225*	9.516*	.729**	-.180
8B	8A + APT	25.074*	-.232*	8.829*	.834**	-.222
8C	8B + COG	25.061*	-.247*	8.431*	1.115*	-.277
8D	8C + ATT	25.055*	-.253*	8.382*	1.244*	-.304

*p < .001 **p < .05

Table 29. DLI Language Difficulty Category IV Standardized Regression Weights: Reading

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
8B	Intercept	APT	.823	.066	12.562	< .001
	Slope	APT	.014	.030	.466	.641
8C	Intercept	APT	.557	.071	7.860	< .001
	Slope	APT	.031	.037	.842	.400
	Intercept	COG	.694	.071	9.798	< .001
	Slope	COG	-.046	.038	-1.231	.218

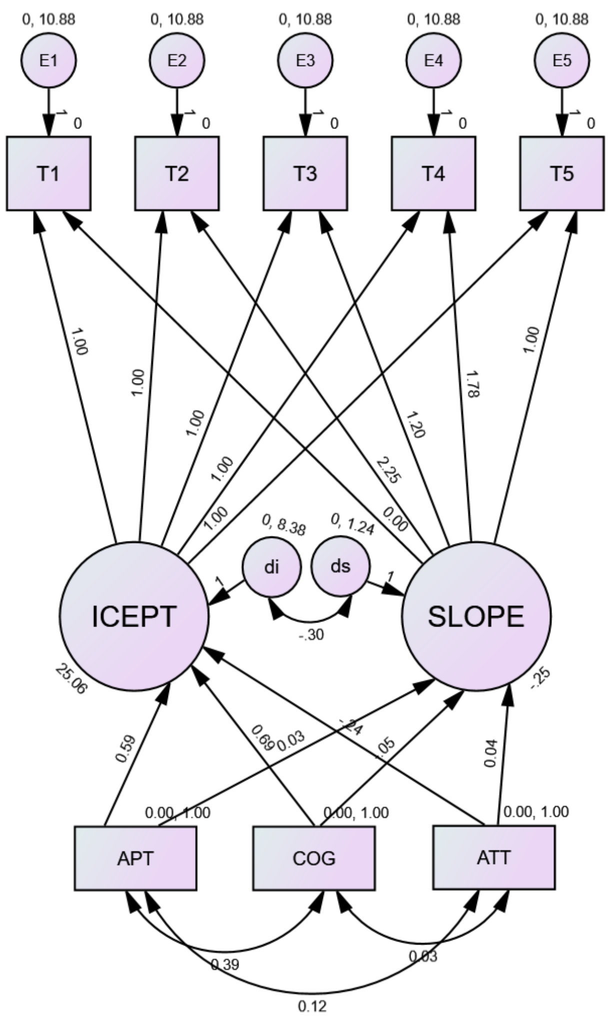
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
8D	Intercept	APT	.588	.072	8.214	< .001
	Slope	APT	.028	.039	.704	.481
	Intercept	COG	.692	.071	9.738	< .001
	Slope	COG	-.050	.040	-1.254	.210
	Intercept	ATT	-.241	.072	-3.327	< .001
	Slope	ATT	.037	.040	.934	.350

**p < .05

For the final model, 8D, (Figure 23), all residual variances were positive and significant (E1 = 10.880; *SE* = .163; CR = 66.850, *p* < .001; E2 = 10.880; *SE* = .163; CR = 66.850, *p* < .001; E3 = 10.880; *SE* = .163; CR = 66.850, *p* < .001; E4 = 10.880; *SE* = .163; CR = 66.850, *p* < .001; E5 = 10.880; *SE* = .163; CR = 66.850, *p* < .001). Both COG and APT were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial DLPT Reading scores for participants in DLI Language Difficulty Category IV languages. The covariance between COG and APT is also positive and significant, so even though the prediction value of APT on the intercept decreases from one model to the next (see Table 24), this is likely due to COG being entered into the models. The covariance between APT and ATT was positive and significant. ATT was also a significant predictor of the intercept; however, the regression weight is negative, indicating that those participants with higher levels of attitude had lower initial DLPT reading scores and those with lower levels of attitude had higher initial DLPT reading scores. None of the predictors were significant predictors of the slope. This may be because although the slope was significant, there was a limited amount of growth in the DLI Language Difficulty Category IV DLPT reading population.

Figure 23

Path Diagram DLI Language Difficulty Category IV Reading: Phase I Model 8D



Chapter 5: Results: Phases II, III, and IV

The results from Phases II, III, and IV will be summarized in this chapter. An important distinction between Phases I and Phases II, III, and IV is that for Phase I DLPT ILR converted scores were used for the outcome variable (DLPT Reading and Listening). However, for Phases II, III, and IV the measures of language proficiency were the DLPT Listening and Reading raw scores. Raw scores do not equate across languages; therefore, conducting separate language analyses was necessary to enable the use of raw scores. Raw scores are more precise because they are the number of correct answers. Unlike ILR ratings (e.g., 0, 0+, 1, 1+) and converted ILR scores (e.g.,0, 6, 10, 16), raw scores are not weighted, transformed, or converted. Previous research that used the DLPT as an outcome measure did not use raw scores, so the use of raw scores is unique to this study.

The purpose of Phase II was to conduct analyses that would provide insight regarding the mean growth trajectories of the individual languages (Spanish, Persian, Russian, Chinese, Korean, Arabic); to determine the impact of main predictors (general cognitive ability, language aptitude, and attitude towards learning assigned language) on initial language proficiency levels and language proficiency change of the participants; and to reveal how the impact of the main predictors may differ by language and modality. Phase III is a continuation of the individual language analyses with the addition of the subtests for the ASVAB and DLAB. ATT was included in the models in Phase III when it was significant in Phase II. The subtests were methodically added to the base models one at a time, and any predictors that were not significant were excluded from subsequent models. The purpose of Phase III was to determine the influence of the individual subtests of the ASVAB and DLAB, and what they measure, on language proficiency outcomes and to determine if there are between-language and modality differences.

In Phase IV, all significant predictors from Phase III were included in the first model and the additional predictors (GPA, AGE, EDUC, TRN_HRS, BILLET and SEX) were added methodically one at a time. Any predictors that were not significant were excluded from the subsequent analyses. The purpose of Phase IV was to conduct analyses that would provide insight into the predictive value of the additional predictors on language proficiency outcomes. The final models for Phases III and IV only included significant predictors. The results Phases II, III, and IV provide insight into the mean growth trajectories of participants of the individual languages, the predictive value of the main predictors and additional predictors on language proficiency outcomes, and the relationship between the predictors. Model fit statistics, parameter statistics, and regression weights are provided within the text, and variance and covariances are provided in the Appendix. A bivariate correlation table for all of the predictors is also provided in the Appendix (Table 211).

In this chapter, the results from Phases II, III, and IV are presented by language and modality, starting with Spanish Listening. Table 30 provides a summary of the models included in Phases II, III, and IV.

Table 30. Phase II, III, IV Analyses and Models.

Dataset	**Phase**	**Models**
DLPT Listening: Spanish	II	9AA (linear) 9A (non-linear)* 9B (9A + COG) 9C (9B + APT) 9D (9C + ATT)
	III	9E (9A + WK) 9F (9E + PC) 9G (9E + AR) 9H (9E + MK) 9I (9E + PT3) 9J (9I + PT2) 9K (9J + PT1) 9L (9K + PT4)
	IV	9M (9K + GPA) 9N (WK, PT2, GPA, AGE)

Dataset	Phase	Models
		9O (9N + EDUC)
		9P (9N + TRN_HRS)
		9Q (9N + BILLET)
		9R (9N + SEX)
DLPT Reading: Spanish	II	10AA (linear)**
		10A (non-linear)**
DLPT Listening: Persian	II	11AA (linear)
		11A (non-linear)*
		11B (11A + COG)
		11C (11B + APT)
		11D (11C + ATT)
	III	11E (11A + PT3)
		11F (11E + PT2)
		11G (11F + PT1)
		11H (11G + PT4)
		11I (11H + WK)
		11J (11I + PC)
		11K (11J + AR)
		11L (11K – PT4 + MK)
		11M (11L – MK)
	IV	11N (11M + GPA)
		11O (11N – PT1 + AGE)
		11P (11O + EDUC)
		11Q (11O + TRN_HRS)
		11R (11O + BILLET)
		11S (11O + SEX)
DLPT Reading: Persian	II	12AA (linear)
		12A (non-linear)*
		12B (12A + COG)
		12C (12B + APT)
		12D (12C + ATT)
	III	12E (12A + PT3)
		12F (12E + PT2)
		12G (12E + PT1)
		12H (12G + PT4)
		12I (12H + WK)
		12J (12I + PC)
		12K (12J + AR)
		12L (12J + MK)
		12M (12L – PT4 + ATT)
	IV	12N (12M + GPA)
		12O (12N – PT3,PT1 + AGE)
		12P (12O – AGE + EDUC)
		12Q (12P + TRN_HRS)
		12R (12P + BILLET)
		12S (12R + SEX)
DLPT Listening: Russian	II	13AA (linear)
		13A (non-linear)*
		13B (13A + COG)

Dataset	Phase	Models
		13C (13B + APT)
		13D (13C + ATT)
	III	13E (13A + PT3)
		13F (13E + PT2)
		13G (13E + PT1)
		13H (13E + PT4)
		13I (13H + WK)
		13J (13I + PC)
		13K (13J + AR)
		13L (13K – PT3 + MK)
		13M (13L – MK)
	IV	13N (13M + GPA)
		13O (13N – AR + AGE)
		13P (13O – AGE + EDUC)
		13Q (13P + TRN_HRS)
		13R (13P + BILLET)
		13S (13P + SEX)
DLPT Reading: Russian	II	14AA (linear)
		14A (non-linear)*
		14B (14A + COG)
		14C (14B + APT)
		14D (14C + ATT)
	III	14E (14A + PT3)
		14F (14E + PT2)
		14G (14E + PT1)
		14H (14G + PT4)
		14I (14H + WK)
		14J (14I + PC)
		14K (14J + AR)
		14L (14K – PT3 + MK)
		14M (14L – MK + ATT)
	IV	14N (14M + GPA)
		14O (14N – AR + AGE)
		14P (14O – AGE + EDUC)
		14Q (14P – EDUC + TRN_HRS)
		14R (14P – EDUC + BILLET)
		14S (14P – EDUC + SEX)
DLPT Listening: Chinese	II	15AA (linear)
		15A (non-linear)*
		15B (15A + COG)
		15C (15B + APT)
		15D (15C + ATT)
	III	15E (15A + PT3)
		15F (15E + PT2)
		15G (15F + PT1)
		15H (15G + PT4)
		15I (15H + WK)
		15J (15G+ PC)
		15K (15J + AR)

Dataset	Phase	Models
		15L (15J + MK)
	IV	15M (15L + GPA)
		15N (15M – MK + AGE)
		15O (15N + EDUC)
		15P (15N + TRN_HRS)
		15Q (15N + BILLET)
		15R (15N + SEX)
DLPT Reading: Chinese	II	16AA (linear)
		16A (non-linear)*
		16B (16A + COG)
		16C (16B + APT)
		16D (16C + ATT)
	III	16E (16A + PT3)
		16F (16E + PT2)
		16G (16E + PT1)
		16H (16G + PT4)
		16I (16H + WK)
		16J (16I+ PC)
		16K (16J – WK+ AR)
		16L (16J – WK + MK)
		16M (16L – MK)
	IV	16N (16M + GPA)
		16O (16N – PT3, PT1+ AGE)
		16P (16O – AGE + EDUC)
		16Q (16P – EDUC + TRN_HRS)
		16R (16Q + BILLET)
		16S (16Q + SEX)
DLPT Listening: Korean	II	17AA (linear)
		17A (non-linear)*
		17B (17A + COG)
		17C (17B + APT)
		17D (17C + ATT)
	III	17E (17A + PT3)
		17F (17A+ PT2)
		17G (17A + PT1)
		17H (17G + PT4)
		17I (17H – PT1 + WK)
		17J (17I – WK + PC)
		17K (17J + AR)
		17L (17K + MK)
		17M (17L – AR)
	IV	17N (17M + GPA)
		17O (17N – PT4, MK + AGE)
		17P (17O + EDUC)
		17Q (17O + TRN_HRS)
		17R (17O + BILLET)
		17S (17O + SEX)
DLPT Reading: Korean	II	18AA (linear)
		18A (non-linear)*

Dataset	Phase	Models
		18B (18A + COG)
		18C (18B + APT)
		18D (18C + ATT)
	III	18E (18A + PT3)
		18F (18E + PT2)
		18G (18E + PT1)
		18H (18G + PT4)
		18I (18H + WK)
		18J (18H + PC)
		18K (18J + AR)
		18L (18K – PT3 + MK)
	IV	18L (18K – PT3 + MK)
		18M (18L + GPA)
		18N (18M – PT1, MK + AGE)
		18O (18N + EDUC)
		18P (18N + TRN_HRS)
		18Q (18N + BILLET)
		18R (18N + SEX)
DLPT Listening: Arabic MSA	II	19AA (linear)
		19A (non-linear)*
		19B (19A + COG)
		19C (19B + APT)
		19D (19C + ATT)
	III	19E (19A + PT3)
		19F (19E+ PT2)
		19G (19F + PT1)
		19H (19G + PT4)
		19I (19H – PT4 + WK)
		19J (19I + PC)
		19K (19I + AR)
		19L (19K – PT3 + MK)
		19M (19L – MK)
	IV	19N (19M + GPA)
		19O (19N – PT2, PT1, AR + AGE)
		19P (19O – AGE + EDUC)
		19Q (19P – EDUC + TRN_HRS)
		19R (19Q + BILLET)
		19S (19Q + SEX)
DLPT Reading: Arabic MSA	II	20AA (linear)*
		20A (non-linear)
		20B (18A + COG)
		20C (18B + APT)
		20D (18C + ATT)
	III	20E (20AA + PT3)
		20F (20E + PT2)
		20G (20E + PT1)
		20H (20G + PT4)
		20I (20H + WK)
		20J (20I + PC)

Dataset	Phase	Models
	IV	20K (20J + AR) 20L (20K – PT4 + MK) 20L (20K – PT4 + MK) 20M (20L + GPA) 20N (20M – PT3, PT1 + AGE) 20O (20N – AGE + EDUC) 20P (20N – EDUC + TRN_HRS) 20Q (20P + BILLET) 20R (20P + SEX)

*Selected as base model due to better model fit.
** Very poor model fit. Subsequent analyses not performed.

Note: COG = cognitive aptitude as measured by the ASVAB. APT = language aptitude as measured by the DLAB. ATT = attitude towards learning the assigned language as measured by an attitude Likert item. WK= ASVAB WK (word knowledge). PC = ASVAB PC (paragraph comprehension). AR = ASVAB AR (arithmetic reasoning). MK = ASVAB MK (mathematic knowledge). PT1 = DLAB PT1 (biographical information). PT2 = DLAB PT2 (X). PT3 = DLAB PT3 (X). PT4 = DLAB PT4 (X). EDUC = education level. TRN_HRS = number of language training hours.

Spanish Listening

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Spanish DLPT listening was 607 records. Raw scores were used for the individual language analyses. Raw scores were used because although they are not directly comparable across languages, they provide a more precise measure of participants performance on the DLPT. The descriptive statistics for the Spanish listening sample are shown in Table 31. 70% of the sample had four test occasions, 44.3% had five test occasions. Figure 24 displays the mean DLPT listening scores at each test occasion. The average listening proficiency slightly increased from one test occasion to the next with the largest increase occurring between Time2 and Time3. The *SDs* and variances indicate that there are between participant differences in scores and that the spread between participants decreases slightly from one test occasion to the next. The skew and kurtosis values show that the distributions of Spanish listening scores at all test occasions are slightly negatively skewed and that the scores are slightly platykurtic or slightly leptokurtic.

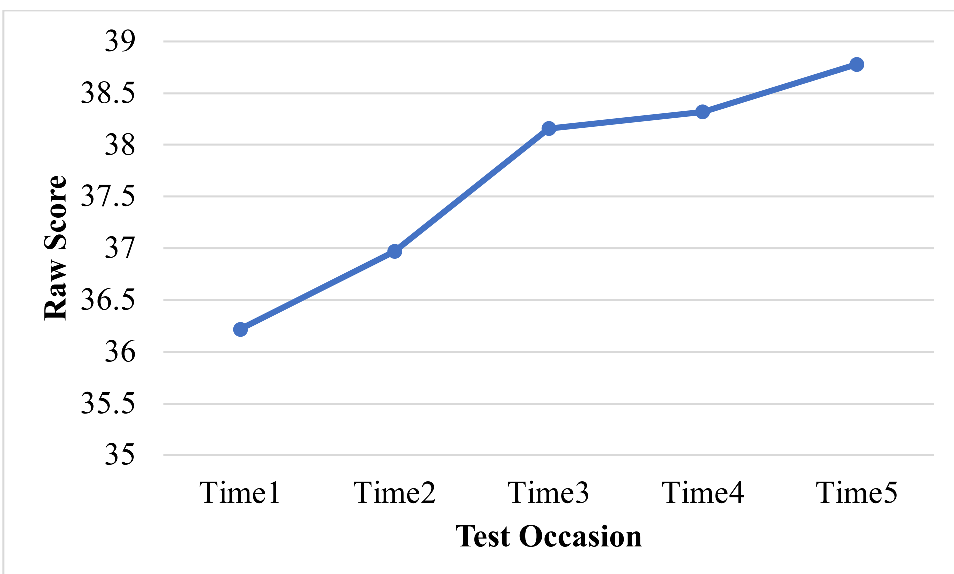
Table 31. Spanish Listening Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	607	36.22	.235	5.787	33.486	-.314	.099	.444	.198
Time2	607	36.97	.230	5.667	32.114	-.133	.099	-.039	.198
Time3	607	38.16	.213	5.252	27.584	-.341	.099	.068	.198
Time4	425	38.32	.245	5.057	25.573	-.485	.118	.774	.236
Time5	269	38.78	.295	4.833	23.361	-.185	.149	-.406	.296
APT*	607	109.77	.418	10.297	106.024	1.018	.099	1.435	.198
COG*	607	88.64	.331	8.162	66.616	-.969	.099	.749	.198
ATT*	553	3.82	.039	.915	.837	-.176	.104	-.445	.207

***Descriptive statistics before standardization**

Figure 24

Mean DLPT Listening Scores by Test Occasion: Spanish



As with the analyses in Phase I, two growth models, linear and non-linear were compared for Spanish listening. The linear model, Model 9AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 9A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 9A indicated a better model fit (χ^2= 126.914, *df* = 11, *p* = .00; CFI = .920; RMSEA = .003, CI = .003-.004) than Model 9AA (χ^2= 141.126, *df* = 14 , *p* = .00; CFI = .912; RMSEA = .003, CI = .003-.004). This was not surprising given the slight curves in Figure 25. Therefore, Model 9A was accepted as the base model.

For Model 9A, the mean slope was positive and significant (*M* = 2.831, *p* < .001) indicating that the Spanish DLPT listening scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 36.045, *p* < .001). The significant negative covariance between the slope and the intercept (-4.580, *p* < .001) indicates that higher initial scores on the Spanish DLPT Listening were associated with lower rates of change and that lower initial scores on the Spanish DLPT Listening were associated with higher rates of change over time. The slope variance (6.487, *p* < .001) was significant indicating that there were significant inter-participant differences in language proficiency change over the five test occasions. The intercept variance (23.045, *p* < .001) was significant indicating that there were significant inter-participant differences on the initial Spanish DLPT Listening score. Table 33 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: general cognitive ability (COG), language aptitude (APT), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Difficulty Category I languages (See Chapter 4). The model fit statistics for all models are listed in Table

32, the parameter statistics are listed in Table 33, and the standardized regression weights are listed in Table 34.

Table 32. Spanish Listening Model Fit Statistics

Model	*Model Variables*	χ^2	*df*	*P*	CFI	RMSEA	CI
9A	Base	126.914	11	.000	.920	.003	.003 - .004
9B	9A + COG	128.198	14	.000	.922	.003	.002 - .003
9C	9B + APT	134.854	17	.000	.924	.003	.002 - .003
9D	9C + ATT	137.417	20	.000	.924	.002	.002 - .003

Table 33. Spanish Listening Parameter Statistics

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
9A	Base	36.045*	2.831*	23.045*	6.487*	-4.580*
9B	9A + COG	36.038*	2.816*	22.274*	6.585*	-4.340*
9C	9B + APT	36.039*	2.843*	21.330*	6.484*	-4.270**
9D	9C + ATT	36.039*	2.838*	21.291*	6.474*	-4.252**

*p < .001 **p < .05

Table 34. Spanish Listening Standardized Regression Weights

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
9B	Intercept	COG	.934	.222	4.206	<.001
	Slope	COG	-.425	.208	-1.997	.046
9C	Intercept	COG	.628	.229	2.740	.006
	Slope	COG	-.393	.218	-1.806	.071
	Intercept	APT	1.002	.229	4.379	<.001
	Slope	APT	-.044	.217	-.203	.839
9D	Intercept	COG	.613	.229	2.70	.008
	Slope	COG	-.385	.218	-1.766	.077
	Intercept	APT	1.022	.230	4.449	<.001
	Slope	APT	-.056	.217	-.257	.797
	Intercept	ATT	-.213	.230	-.927	.354
	Slope	ATT	.111	.217	.513	.608

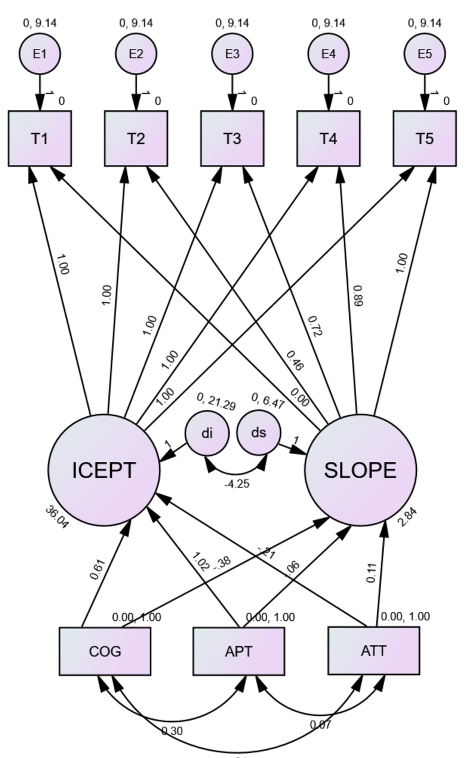
**p < .05

For the final model, Model 9D (Figure 25), the residual variances were all positive and significant (E1 = 9.137; *SE* = .352, CR = 25.938, *p* < .001; E2 = 9.137; *SE* = .352, CR = 25.938, *p* < .001; E3 = 9.137; *SE* = .352, CR = 25.938, *p* < .001; E4 = 9.137; *SE* = .352, CR = 25.938, *p*

< .001; E5 = 9.137; *SE* = .352, CR = 25.938, $p < .001$). Both COG and APT were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial Spanish Listening scores. The covariance between COG and APT is also significant, so even though the prediction value of COG on the intercept decreases from one model to the next (see Table 34) this is likely due to APT being entered into the models. Interestingly, APT was a stronger predictor than COG. This goes against the prediction that COG would have more predictive value for Category I languages. ATT was not a significant predictor of the intercept and none of the predictors were significant predictors of the slope. This may be because although the slope was significant, there was a limited amount of growth in the Spanish listening population.

Figure 25

Path Diagram Spanish Listening: Phase II Model 9D



Phase III

The same dataset from Spanish Listening Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time. ATT was not added to the model as it was not significant in Phase II. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 35.

Table 35. Spanish Listening Descriptive Statistics: ASVAB and DLAB Subtests

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
ASVAB_WK*	607	60.57	.243	5.995	35.944	.121	.099	-.163	.198
ASVAB_PC*	607	61.01	.185	4.548	20.685	-.373	.099	-.073	.198
ASVAB_AR*	607	61.55	.212	5.225	27.300	-.091	.099	-.203	.198
ASVAB_MK*	607	61.83	.199	4.910	24.105	-.127	.099	-.293	.198
DLAB_PT1*	607	2.94	.064	1.584	2.508	.231	.099	-.507	.198
DLAB_PT2*	607	12.32	.120	2.954	8.726	-.228	.099	-.553	.198
DLAB_PT3*	607	43.45	.225	5.553	30.836	.142	.099	.035	.198
DLAB_PT4*	607	17.75	.167	4.122	16.994	-.078	.099	.199	.198

Descriptive statistics before standardization

ASVAB subtests were entered into the model first because existing literature suggests that general cognitive ability, as measured by the ASVAB, has more of an impact on language proficiency than language aptitude, as measured by the DLAB, for DLI Difficulty Category I languages. The subtests were entered in the following order, one at a time: ASVAB WK (word knowledge), ASVAB PC (paragraph comprehension), ASVAB AR (arithmetic reasoning), ASVAB MK (math knowledge), DLAB_PT3 (grammar), DLAB_PT2 (stress patterns), DLAB_PT1 (biographical questions), DLAB_PT4 (picture-word association). When a subtest was not a significant predictor, it was excluded from the next model. ASVAB WK and PC were entered in the model before ASVAB AR and MK because they test verbal knowledge and skills (word knowledge and paragraph comprehension). Due to the scarcity of research using the different parts of the DLAB, the parts of the DLAB were entered in a specific order based on anecdotal evidence and conversations with DLI faculty, leadership, and former students. The model fit statistics for all models are listed in Table 36, the parameter statistics are listed in Table 37, and the standardized regression weights are listed in Table 38. ASVAB subtests and DLAB subtests are abbreviated in the tables: ASVAB WK (WK), ASVAB PC (PC), ASVAB AR (AR), ASVAB MK (MK), DLAB PT 1 (PT1), DLAB PT2 (PT2), DLAB PT3 (PT3), DLAB PT4 (PT4).

Table 36. Spanish Listening Model Fit Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	χ^2	*df*	*p*	**CFI**	**RMSEA**	**CI**
9A	Base	126.914	11	.000	.920	.003	.003 - .004
9E	9A + WK	129.259	14	.000	.921	.003	.002 - .003
9F	9E + PC	138.042	17	.000	.923	.003	.002 - .003
9G	9E + AR	130.082	17	.000	.923	.003	.002 - .003
9H	9E + MK	129.330	17	.000	.923	.003	.002 - .003
9I	9E + PT3	137.197	17	.000	.920	.003	.002 - .003
9J	9I + PT2	144.499	20	.000	.918	.003	.002 - .003
9K	9J + PT1	149.662	23	.000	.917	.002	.002 - .003
9L	9K + PT4	154.480	26	.000	.918	.002	.002 - .003

Table 37. Spanish Listening Parameter Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope (S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
9A	Base	36.045*	2.831*	23.045*	6.487*	-4.580*
9E	9A + WK	36.040*	2.830*	22.200*	6.422*	-4.203**
9F	9E + PC	36.038*	2.823*	22.129*	6.517*	-4.217**
9G	9E + AR	36.040*	2.830*	22.044*	6.450*	-4.224**
9H	9E + MK	36.040*	2.831*	22.195*	6.476*	-4.260**
9I	9E + PT3	36.042*	2.860*	21.435*	6.370*	-4.283**
9J	9I + PT2	36.035*	2.848*	21.239*	6.598*	-4.287**
9K	9J + PT1	36.032*	2.847*	20.939*	6.709*	-4.167**
9L	9K + PT4	36.033*	2.866*	20.880*	6.556*	-4.087**

*p < .001 **p < .05

Table 38. Spanish Listening Standardized Regression Weights: ASVAB and DLAB Subtests

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
9E	Intercept	WK	.945	.222	4.263	<.001

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	WK	-.483	.208	-2.324	.020**
9F	Intercept	WK	.786	.245	3.206	.001**
	Slope	WK	-.414	.230	-1.802	.072
	Intercept	PC	.371	.245	1.511	.131
	Slope	PC	-.159	.229	-.692	.489
9G	Intercept	WK	.883	.224	3.943	<.001
	Slope	WK	-.491	.211	-2.333	.020**
	Intercept	AR	.398	.224	1.780	.075
	Slope	AR	.067	.209	.319	.750
9H	Intercept	WK	.940	.222	4.236	<.001
	Slope	WK	-.487	.208	-2.338	.019**
	Intercept	MK	.154	.222	.695	.487
	Slope	MK	.115	.207	.556	.578
9I	Intercept	WK	.800	.222	3.611	<.001
	Slope	WK	-.490	.211	-2.322	.020**
	Intercept	PT3	.880	.221	3.975	<.001
	Slope	PT3	.059	.210	.281	.779
9J	Intercept	WK	.814	.221	3.681	<.001
	Slope	WK	-.500	.212	-2.358	.018**
	Intercept	PT3	.790	.224	3.526	<.001
	Slope	PT3	.102	.214	.478	.632
	Intercept	PT2	.547	.221	2.473	.013**
	Slope	PT2	-.245	.211	-1.305	.192
9K	Intercept	WK	.768	.221	3.477	<.001
	Slope	WK	-.474	.213	-2.226	.026**
	Intercept	PT3	.760	.223	3.404	<.001
	Slope	PT3	.122	.214	.570	.568
	Intercept	PT2	.557	.220	2.530	.011**
	Slope	PT2	-.288	.212	-1.362	.173
	Intercept	PT1	.601	.218	2.756	.006**
	Slope	PT1	-.358	.210	-1.704	.088
9L	Intercept	WK	.754	.226	3.331	<.001
	Slope	WK	-.507	.219	-2.319	.020**
	Intercept	PT3	.756	.223	3.393	<.001
	Slope	PT3	.128	.214	.599	.549
	Intercept	PT2	.560	.221	2.534	.011**
	Slope	PT2	-.268	.213	-1.261	.207
	Intercept	PT1	.598	.218	2.746	.006**

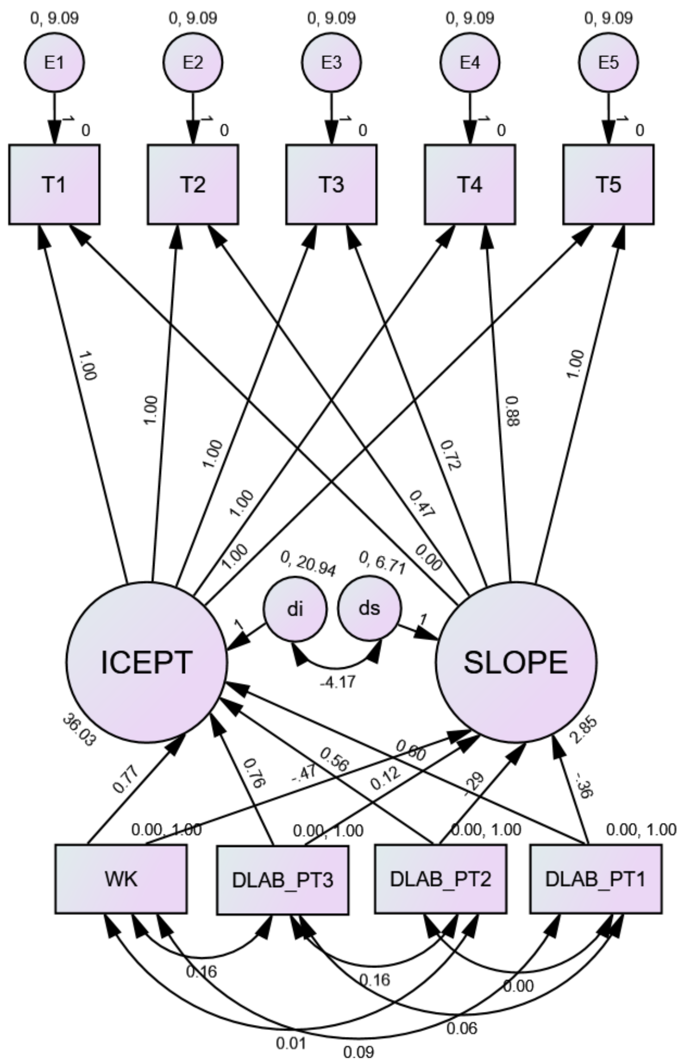
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	PT1	-.362	.210	-1.723	.085
	Intercept	PT4	.055	.224	.245	.806
	Slope	PT4	.148	.216	.684	.494

**p < .05

For the final model, 9K, (Figure 26), all residual variances were positive and significant (E1 = 9.093; SE = .351; CR = 25.920, p < .001; E2 = 9.093; SE = .351; CR = 25.920, p < .001; E3 = 9.093; SE = .351; CR = 25.920, p < .001; E4 = 9.093; SE = .351; CR = 25.920, p < .001; E5 = 9.093; SE = .351; CR = 25.920, p < .001). 9K was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 38). ASVAB WK had the largest regression weight (.768), followed by DLAB PT3 (.760), DLAB PT1 (.601), and DLAB PT2 (.557). These results suggest that those participants who had higher scores on these subtests were more likely to have higher DLPT listening scores at graduation. The only subtest that had a significant predictive value for the slope was ASVAB WK and it was negative (-.474), implying that those participants who had higher scores on the ASVAB WK experienced slightly less growth in listening language proficiency (as measured by the DLPT) over the five test occasions. ASVAB PC, ASVAB AR, ASVAB MK, and DLAB PT4 were not found to be significant predictors of the intercept or slope. There was a significant covariance between several of the subtests including ASVAB WK and ASVAB AR, ASVAB PC, and DLAB PT4, indicating that the predictive value of these predictors may have been reduced because they covary with the strongest predictor in the model.

Figure 26

Path Diagram Spanish Listening: Phase III Model 9K



Phase IV

The same dataset from Spanish Listening Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 9K (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 39.

Table 39. Spanish Listening Descriptive Statistics: Other predictors

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
GPA*	569	3.37	.016	.382	.146	-.913	.102	2.074	.204
AGE*	553	22.14	.149	3.494	12.206	1.188	.104	1.826	.207
EDUC*	553	3.90	.086	2.026	4.103	.574	.104	-1.088	.207
TRN_HRS*	254	351.56	13.747	219.084	47997.852	1.200	.153	2.051	.304
BILLET	466	.58	.023	.495	.245	-.314	.113	-1.910	.226
SEX	607	.73	.018	.444	.197	-1.047	.099	-.907	.198

Descriptive statistics before standardization

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The predictors were entered in a specific order based on the limited amount of longitudinal research that exists that has examined the relationship between these predictors and language proficiency. The model fit statistics for all models are listed in Table 40, the parameter statistics are listed in Table 41, and the standardized regression weights are listed in Table 42.

Table 40. Spanish Listening Model Fit Statistics: Other Predictors

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
9K	9J + PT1	149.662	23	.000	.917	.002	.002 - .003
9M	9K +GPA	151.687	26	.000	.925	.002	.002 - .003
9N	WK, PT2, GPA, AGE	137.755	23	.000	.931	.002	.002 - .003
9O	9N + EDUC	143.727	26	.000	.941	.002	.002 - .002
9P	9N + TRN_HRS	141.792	26	.000	.931	.002	.002 - .002
9Q	9N + BILLET	144.569	26	.000	.929	.002	.002 - .002
9R	9N + SEX	138.416	26	.000	.933	.002	.002 - .002

Table 41. Spanish Listening Parameter Statistics: Other Predictors

		Intercept (I)	**Slope (S)**			
Model	***Model Variables***	***M***	***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
9K	9J + PT1	36.032*	2.847*	20.939*	6.709*	-4.167**
9M	9K + GPA	35.999*	2.849*	17.644*	6.607*	-4.068**

Model	Model Variables	Intercept (I) M	Slope (S) M	Variance (I)	Variance (S)	I/S Covariance
9N	WK, PT2, GPA, AGE	36.009*	2.839*	17.407*	6.167*	-3.634*
9O	9N + EDUC	36.014*	2.850*	17.321*	5.964*	-3.513*
9P	9N + TRN_HRS	36.004*	2.849*	17.125*	5.843*	-3.735**
9Q	9N + BILLET	35.926*	3.066*	17.365*	6.042*	-3.559**
9R	9N + SEX	35.688*	2.801*	17.367*	6.186*	-3.633**

*p < .001 **p < .05

Table 42. Spanish Listening Standardized Regression Weights: Other Predictors

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
9M	Intercept	WK	.623	.209	2.979	.003**
	Slope	WK	-.455	.213	-2.134	.033**
	Intercept	PT3	.361	.216	1.674	.094
	Slope	PT3	.131	.219	.599	.549
	Intercept	PT2	.415	.208	1.990	.047**
	Slope	PT2	-.281	.212	-1.323	.186
	Intercept	PT1	.346	.208	1.662	.097
	Slope	PT1	-.363	.212	-1.712	.087
	Intercept	GPA	1.889	.219	8.640	<.001
	Slope	GPA	-.024	.223	-.109	.913
9N	Intercept	WK	.438	.222	1.977	.048**
	Slope	WK	-.221	.224	-.987	.324
	Intercept	PT2	.438	.205	2.130	.033**
	Slope	PT2	-.224	.208	-1.079	.281
	Intercept	GPA	2.033	.211	9.656	<.001
	Slope	GPA	-.061	.214	-.286	.774
	Intercept	AGE	.725	.228	3.179	.001**
	Slope	AGE	-.668	.232	-2.873	.004**
9O	Intercept	WK	.415	.222	1.865	.062
	Slope	WK	-.197	.225	-.876	.381
	Intercept	PT2	.441	.205	2.151	.031**
	Slope	PT2	-.227	.207	-1.095	.274
	Intercept	GPA	2.016	.211	9.562	<.0001
	Slope	GPA	-.041	.214	-.190	.849
	Intercept	AGE	.580	.289	2.004	.045
	Slope	AGE	-.511	.293	-1.742	.082
	Intercept	EDUC	.233	.285	.816	.415

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	EDUC	-.251	.289	-.869	.385
9P	Intercept	WK	.384	.224	1.716	.086
	Slope	WK	-.262	.227	-1.156	.248
	Intercept	PT2	.421	.206	2.050	.040**
	Slope	PT2	-.221	.208	-1.062	.288
	Intercept	GPA	2.025	.211	2.050	<.001
	Slope	GPA	-.073	.214	-.340	.734
	Intercept	AGE	.690	.229	3.014	.003**
	Slope	AGE	-.698	.234	-2.985	.003**
	Intercept	TRN_HRS	-.472	.310	-1.522	.128
	Slope	TRN_HRS	-.405	.310	-1.308	.191
9Q	Intercept	WK	.436	.221	1.973	.048**
	Slope	WK	-.216	.223	-.968	.333
	Intercept	PT2	.442	.206	2.142	.032
	Slope	PT2	-.237	.208	-1.138	.255
	Intercept	GPA	2.035	.210	9.675	<.001
	Slope	GPA	-.066	.213	-.310	.757
	Intercept	AGE	.724	.228	3.180	.001**
	Slope	AGE	-.672	.232	-2.896	.004**
	Intercept	BILLET	.148	.471	.314	.754
	Slope	BILLET	-.383	.471	-.814	.416
9R	Intercept	WK	.416	.223	1.866	.062
	Slope	WK	-.224	.225	-.993	.321
	Intercept	PT2	.422	.206	2.047	.041**
	Slope	PT2	-.226	.208	-1.086	.278
	Intercept	GPA	2.046	.211	9.707	<.001
	Slope	GPA	-.062	.214	-.292	.771
	Intercept	AGE	.717	.228	3.144	.002**
	Slope	AGE	-.671	.233	-2.884	.004**
	Intercept	SEX	.439	.467	.942	.346
	Slope	SEX	.053	.471	.112	.911

**p < .05

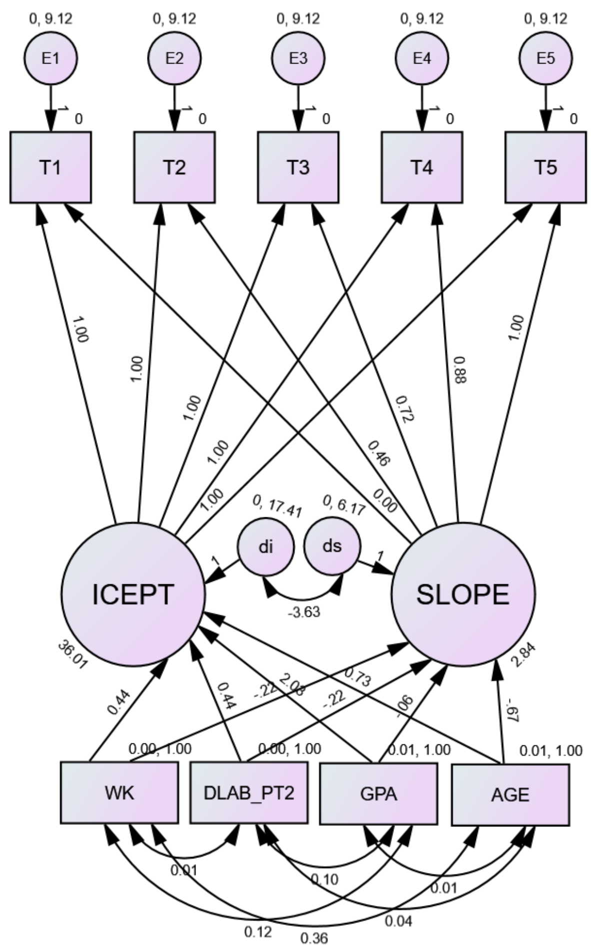
For the final model, 9N, (Figure 27), all residual variances were positive and significant (E1 = 9.119; SE = .352; CR = 25.935, p < .001; E2 = 9.119; SE = .352; CR = 25.935, p < .001; E3 = 9.119; SE = .352; CR = 25.935, p < .001; E4 = 9.119; SE = .352; CR = 25.935, p < .001;

E5 = 9.119; SE = .352; CR = 25.935, p < .001). 9N was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 42). GPA had the largest regression weights on the intercept (2.033), followed by AGE (.725), and ASVAB WK (.438) and DLAB PT2 (.438). These results suggest that those participants who had higher GPAs at DLI, who were older, and who had higher scores on the WK and PT2 subtests were more likely to have higher DLPT listening scores at graduation. The only predictor that had a significant predictive value for the slope was AGE and it was negative (-.668), implying that those participants who were older experienced slightly less growth in listening language proficiency (as measured by the DLPT) over the five test occasions. EDUC, TRN_HRS, BILLET, and SEX were not found to be significant predictors of the intercept or slope in the analysis (see Table 49). DLAB PT1 and DLAB PT3 were not included in Model 9N because once GPA was entered into 9M they were no longer significant predictors of the intercept. There was a significant covariance between the predictors including between GPA and ASVAB WK and GPA and DLAB PT2, indicating that the predictive value of these predictors may have been reduced because they covary with the strongest predictor in the model.

The results from Phases II, III, and IV for the Spanish DLPT listening suggest that the participants' GPA, age, and performance on the ASVAB WK and DLAB PT2 subtests is related to their performance on the DLPT listening at graduation. Specifically, the results imply that those participants with higher GPAs and higher scores on the WK and PT2 subtests performed better along with participants at the higher end of the age range scale for students at DLI. However, the results also suggest that those participants who were younger when admitted to DLI experienced more growth in language proficiency over the five DLPT listening test occasions.

Figure 27

Path Diagram Spanish Listening: Phase IV Model 9N



Spanish Reading

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Spanish DLPT reading was 616 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Spanish reading sample are shown in Table 43. 69.5% of the sample had four test occasions and 43.3% had five test occasions. Figure 28 displays the mean DLPT reading scores at each test occasion. The average listening proficiency increased from one test occasion to the next with the largest increase occurring between Time1 and Time2. The *SDs* and variances indicate that there are between participant differences in scores and that the spread between participants decreases slightly from one test occasion to the next. The skew and kurtosis values show that the distributions of Spanish reading scores at all test occasions are slightly negatively skewed and that the scores are slightly leptokurtic.

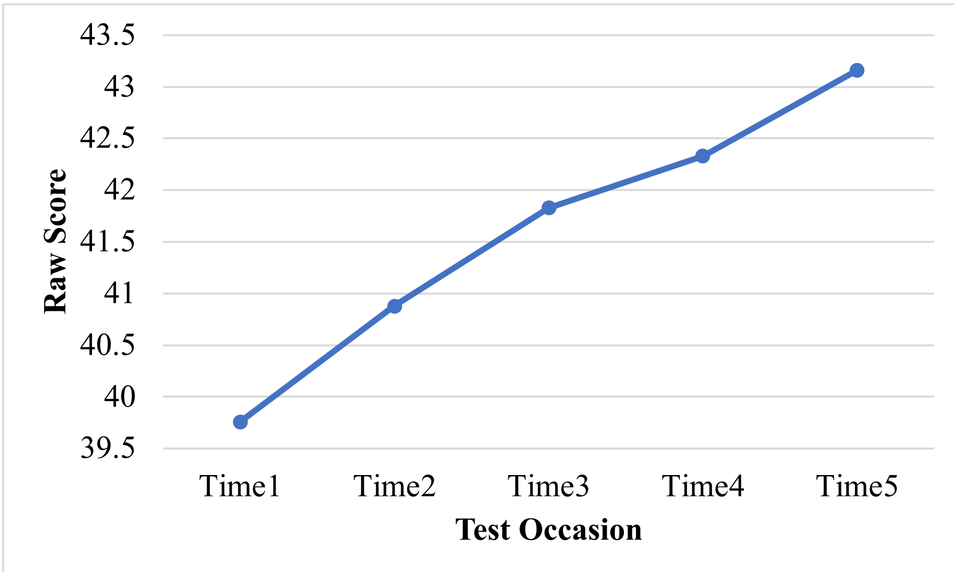
Table 43. Spanish Reading Descriptive Statistics

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
Time1	616	39.76	.237	5.881	34.584	-.795	.098	1.413	.197
Time2	616	40.88	.224	5.549	30.788	-.798	.098	.920	.197
Time3	616	41.83	.216	5.350	28.626	-.703	.098	.334	.197
Time4	428	42.33	.235	4.871	23.730	-.957	.118	1.822	.235
Time5	266	43.16	.271	4.420	19.532	-.837	.149	1.399	.298
APT*	616	109.81	.414	10.273	105.541	1.003	.098	1.402	.197
COG*	616	88.47	.342	8.480	71.915	-1.099	.098	1.295	.197
ATT*	559	3.81	.039	.911	.830	-.162	.103	-.438	.206

***Descriptive statistics before standardization**

Figure 28

Mean DLPT Reading Scores by Test Occasion: Spanish



As with the Phase I analyses, two growth models, linear and non-linear were compared for Spanish Reading. The linear model, Model 10AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 10A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. For both models, the slope variance was set to a constant, 1, so the models would converge. Model 10AA indicated a slightly better model fit (χ^2= 381.432, *df* = 16, *p* = .00; CFI = .643; RMSEA = .005, CI = .004-.005) than Model 10A (χ^2= 379.605, *df* = 13, *p* = .00; CFI = .642; RMSEA = .005, CI = .005-.006); however, the CFI values indicated very poor fit for both models. While the RMSEA values did not indicate poor model fit (a value of .005 indicates good model fit for RMSEA; see Chapter 3), the CFI values were both low and indicated poor model fit. CFI provides a measure of the complete covariation in the data. In the case of Spanish Reading, it is suspected that the CFI was low due to covariance of residuals (error terms). Adding the correlation of error terms (the residuals) into a model is a way of improving model fit; however, this method is frowned upon as it means that some other issue that is not specified in the model is causing the covariation between the error terms (Gerbing & Anderson, 1984). 10AA would have been chosen as the base model if the fit were not so poor. Due to the very poor fit of both models, the subsequent analyses were not performed, and predictors were not added to the models.

For Model 10AA, the mean slope was positive and significant ($M = 3.746$, $p < .001$) indicating that the Spanish DLPT reading scores increased over time. The mean intercept was significant ($M = 39.859$, $p < .001$). The covariance between the intercept and slope was set to a constant, 1.0. The slope variance was set to 1.0 so the model would converge. The intercept variance (13.834, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial Spanish DLPT reading score.

Persian Listening

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Persian DLPT listening was 1735 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Persian listening sample are shown in Table 44. 77.8% of the sample had four test occasions, and 55.9% had five test occasions. Figure 29 displays the mean DLPT listening scores at each test occasion. The average listening proficiency decreased between Time1 and Time2 but then increased from one test occasion to the next The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Persian listening scores at all test occasions are slightly negatively skewed and that the scores are slightly platykurtic or slightly leptokurtic.

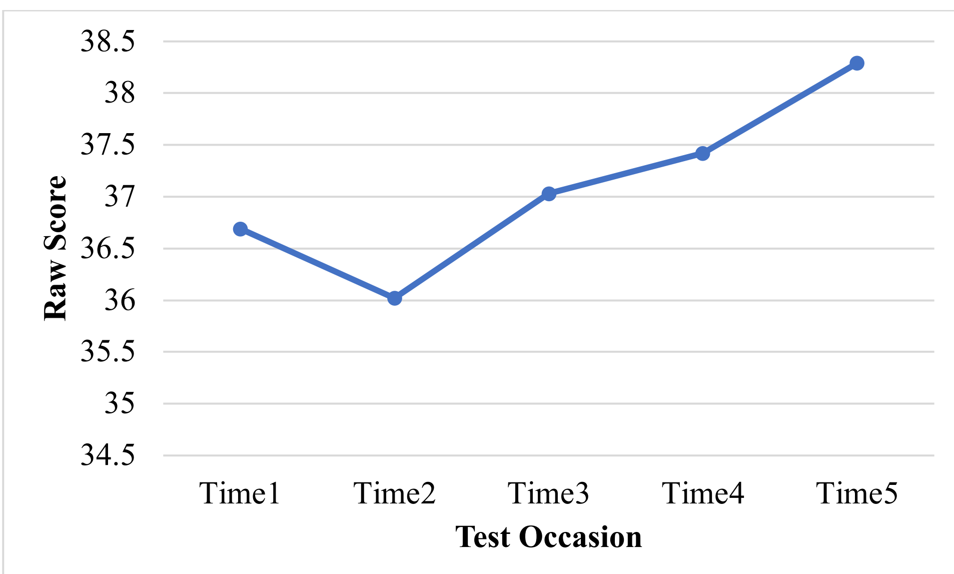
Table 44. Persian Listening Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	1735	36.69	.131	5.466	29.879	-.309	.059	.224	.117
Time2	1735	36.02	.135	5.640	31.806	-.180	.059	-.056	.117
Time3	1735	37.03	.137	5.708	32.579	-.262	.059	-.058	.117
Time4	1350	37.42	.155	5.689	32.367	-.239	.067	-.145	.133
Time5	970	38.29	.172	5.357	28.703	-.328	.079	.269	.157
APT*	1735	113.72	.265	11.024	121.526	.818	.059	.651	.117
COG*	1735	89.81	.201	8.361	69.902	-1.301	.059	1.768	.117
ATT*	1530	3.88	.026	1.000	.999	-.504	.063	-.161	.125

Descriptive statistics before standardization

Figure 29

Mean DLPT Listening Scores by Test Occasion: Persian



As with Phase I analyses, two growth models, linear and non-linear were compared for Persian Listening. The linear model, Model 11AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 11A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 11A indicated a better model fit (χ^2= 108.150, *df* = 11, *p* = .00; CFI = .971; RMSEA = .003, CI = .002-.003) than Model 11AA (χ^2= 187.283, *df* = 14 , *p* = .00; CFI = .948; RMSEA = .003, CI = .003-.004). Therefore, Model 11A was accepted as the base model.

For Model 11A, the mean slope was positive and significant (*M* = 1.535, $p < .001$) indicating that the Persian DLPT listening scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 36.647, $p < .001$). The significant positive covariance between the slope and the intercept (1.212, $p < .05$) indicates that higher initial scores on the Persian DLPT Listening were associated with higher rates of change and that lower initial scores on the Persian DLPT Listening were associated with lower rates of change over time. The slope variance (.627, $p > .05$) was not significant. The intercept variance (18.646, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial Persian DLPT Listening score. Table 46 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Difficulty Category III languages (See Chapter 5). The model fit statistics for all models are listed in Table 45, the parameter statistics are listed in Table 46, and the standardized regression weights are listed in Table 47.

Table 45. Persian Listening Model Fit Statistics

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
11A	Base	108.150	11	.000	.971	.003	.002 - .003

11B	11A + APT	108.883	14	.000	.972	.003	.002 - .003
11C	11B + COG	112.927	17	.000	.974	.002	.002 - .003
11D	11C + ATT	115.527	20	.000	.974	.002	.002 - .003

Table 46. Persian Listening Parameter Statistics

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
11A	Base	36.647*	1.535*	18.646*	.627	1.212**
11B	11A + APT	36.648*	1.555*	18.104*	.960	1.055**
11C	11B + COG	36.644*	1.549*	17.505*	.623	.966**
11D	11C + ATT	36.644*	1.549*	17.500*	.622	.965**

*p < .001 **p < .05

Table 47. Persian Listening Standardized Regression Weights

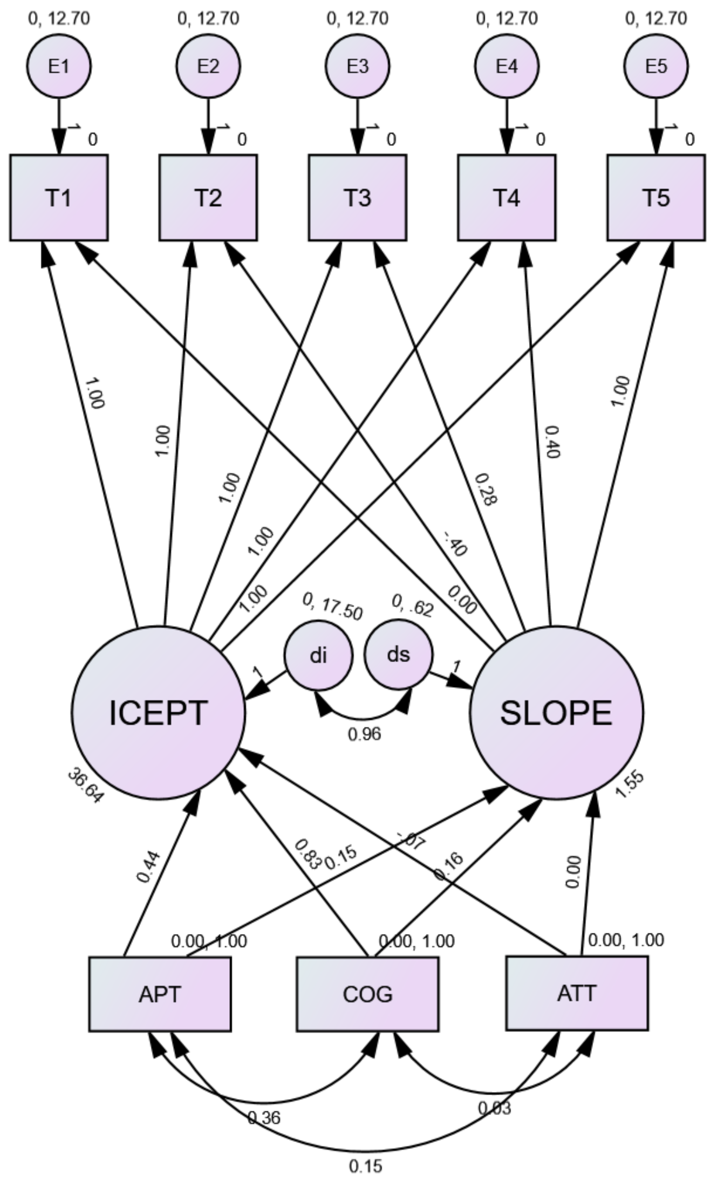
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
11B	Intercept	APT	.733	.112	6.555	< .001
	Slope	APT	.205	.103	1.993	.046**
11C	Intercept	APT	.432	.118	3.658	< .001
	Slope	APT	.149	.109	1.365	.172
	Intercept	COG	.829	.118	7.017	< .001
	Slope	COG	.163	.110	1.492	.136
11D	Intercept	APT	.444	.120	3.713	< .001
	Slope	APT	.149	.111	1.345	.179
	Intercept	COG	.827	.118	6.996	< .001
	Slope	COG	.163	.110	1.491	.136
	Intercept	ATT	-.075	.118	-.633	.527
	Slope	ATT	.002	.109	.021	.983

**p < .05

For the final model, Model 11D (Figure 30), the residual variances were all positive and significant (E1 = 12.696; *SE* = .270, CR = 47.000, $p < .001$; E2 = 12.696; *SE* = .270, CR = 47.000, $p < .001$; E3 = 12.696; *SE* = .270, CR = 47.000, $p < .001$; E4 = 12.696; *SE* = .270, CR = 47.000, $p < .001$; E5 = 12.696; *SE* = .270, CR = 47.000, $p < .001$). Both APT and COG were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial Persian Listening scores. The covariance between APT and COG is also significant, so even though the prediction value of APT on the intercept decreases from one model to the next (see Table 47) this is likely due to COG being entered into the models. Interestingly, COG was a stronger predictor than APT. This goes against the prediction that APT would have more predictive value for DLI Difficulty Category III languages. ATT was not a significant predictor of the intercept and none of the predictors were significant predictors of the slope. This may be because although the mean slope was significant, there was a limited amount of growth in the Persian listening population.

Figure 30

Path Diagram Persian Listening: Phase II Model 11D



Phase III

The same dataset from Persian Listening Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time. ATT was not added to the model as it was not significant in Phase II. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 48.

Table 48. Persian Listening Descriptive Statistics: ASVAB and DLAB Subtests

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
ASVAB_WK*	1735	61.48	.144	5.983	35.794	.000	.059	-.209	.117
ASVAB_PC*	1735	61.46	.113	4.714	22.222	-.481	.059	-.072	.117
ASVAB_AR*	1735	61.88	.126	5.256	27.630	-.333	.059	.152	.117
ASVAB_MK*	1735	62.41	.118	4.899	24.005	-.136	.059	-.354	.117
DLAB_PT1*	1735	3.07	.038	1.563	2.444	.152	.059	-.516	.117
DLAB_PT2*	1735	12.54	.072	3.005	9.029	-.279	.059	-.593	.117
DLAB_PT3*	1735	45.21	.133	5.556	30.865	.252	.059	-.006	.117
DLAB_PT4*	1735	18.76	.098	4.067	16.541	-.174	.059	-.262	.117

Descriptive statistics before standardization

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for DLI Difficulty Category III languages. The subtests were entered in the following order, one at a time: DLAB_PT3 (grammar), DLAB_PT2 (stress patterns), DLAB_PT1 (biographical questions), DLAB_PT4 (picture-word association), ASVAB WK (word knowledge), ASVAB PC (paragraph comprehension), ASVAB AR (arithmetic reasoning), ASVAB MK (math knowledge). When a subtest was not a significant predictor, it was excluded from the next model. ASVAB WK and PC were entered in the model before ASVAB AR and MK because they test verbal knowledge and skills (word knowledge and paragraph comprehension). Due to the scarcity of research using the different parts of the DLAB, the parts of the DLAB were entered in a specific order based on anecdotal evidence and conversations with DLI faculty, leadership, and former students. The model fit statistics for all models are listed in Table 49, the parameter statistics are listed in Table 50, and the standardized regression weights are listed in Table 51. ASVAB subtests and DLAB subtests are abbreviated in the tables: ASVAB WK (WK), ASVAB PC (PC), ASVAB AR (AR), ASVAB MK (MK), DLAB PT 1 (PT1), DLAB PT2 (PT2), DLAB PT3 (PT3), DLAB PT4 (PT4).

Table 49. Persian Listening Model Fit Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
11A	Base	108.150	11	.000	.971	.003	.002 - .003
11E	11A + PT3	110.460	14	.000	.971	.003	.002 - .003
11F	11E + PT2	114.559	17	.000	.971	.003	.002 - .003
11G	11F + PT1	134.091	20	.000	.967	.002	.002 - .003
11H	11G + PT4	134.492	23	.000	.969	.002	.002 - .003
11I	11H + WK	138.844	26	.000	.970	.002	.002 - .002
11J	11I + PC	142.363	29	.000	.973	.002	.002 - .002
11K	11J + AR	146.299	32	.000	.975	.002	.002 - .002
11L	11K – PT4 + MK	151.511	32	.000	.976	.002	.002 - .002
11M	11L – MK	146.045	29	.000	.973	.002	.002 - .002

Table 50. Persian Listening Parameter Statistics: ASVAB and DLAB Subtests

		Intercept (I)	**Slope (S)**			
Model	***Model Variables***	***M***	***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
11A	Base	36.647*	1.535*	18.646*	.627	1.212**
11E	11A + PT3	36.642*	1.546*	18.181*	.619	1.242**
11F	11E + PT2	36.631*	1.577*	18.138*	.453	1.252**
11G	11F + PT1	36.611*	1.594*	17.975*	.465	1.247**
11H	11G + PT4	36.618*	1.601*	17.959*	.405	1.188**
11I	11H + WK	36.607*	1.608*	17.470*	.381	1.119**
11J	11I + PC	36.604*	1.609*	17.252*	.382	1.132**
11K	11J + AR	36.603*	1.607*	17.112*	.392	1.091**
11L	11K – PT4 + MK	36.591*	1.616*	17.067*	.408	1.115**
11M	11L – MK	36.596*	1.605*	17.112*	.430	1.085*

*p < .001 **p < .05

Table 51. Persian Listening Standardized Regression Weights: ASVAB and DLAB Subtests

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
11E	Intercept	PT3	.671	.112	6.009	<.001
	Slope	PT3	-.029	.102	-.281	.779
11F	Intercept	PT3	.650	.113	5.734	< .001
	Slope	PT3	-.081	.105	-.770	.441
	Intercept	PT2	.123	.114	1.074	.283
	Slope	PT2	.281	.107	2.630	.009**
11G	Intercept	PT3	.612	.114	5.374	<.001
	Slope	PT3	-.095	.107	-.885	.376
	Intercept	PT2	.130	.114	1.145	.252
	Slope	PT2	.290	.108	2.685	.007**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Intercept	PT1	.344	.112	3.061	.002**
	Slope	PT1	.126	.106	1.192	.233
11H	Intercept	PT3	.575	.116	4.945	<.001
	Slope	PT3	-.144	.109	-1.316	.188
	Intercept	PT2	.145	.114	1.273	.203
	Slope	PT2	.309	.108	2.864	.004**
	Intercept	PT1	.335	.112	2.987	.003**
	Slope	PT1	.107	.105	1.021	.307
	Intercept	PT4	.185	.115	1.613	.107
	Slope	PT4	.277	.108	2.563	.010**
11I	Intercept	PT3	.464	.117	3.978	<.001
	Slope	PT3	-.172	.111	-1.543	.123
	Intercept	PT2	.129	.113	1.141	.254
	Slope	PT2	.317	.109	2.914	.004**
	Intercept	PT1	.258	.112	2.311	.021**
	Slope	PT1	.103	.107	.966	.334
	Intercept	PT4	.039	.116	.337	.736
	Slope	PT4	.256	.111	2.307	.021**
	Intercept	WK	.716	.116	6.164	<.001
	Slope	WK	.139	.111	1.259	.208
11J	Intercept	PT3	.441	.116	3.799	<.011
	Slope	PT3	-.171	.111	-1.537	.124
	Intercept	PT2	.119	.113	1.059	.290
	Slope	PT2	.317	.109	2.916	.004**
	Intercept	PT1	.248	.111	2.225	.026**
	Slope	PT1	.104	.107	.979	.328
	Intercept	PT4	-.036	.117	-.308	.758
	Slope	PT4	.258	.112	2.302	.021**
	Intercept	WK	.509	.125	4.056	<.001
	Slope	WK	.146	.120	1.213	.225
	Intercept	PC	.522	.124	4.207	<.001
	Slope	PC	-.017	.119	-.142	.887
11K	Intercept	PT3	.382	.117	3.265	.001**
	Slope	PT3	-.198	.112	-1.759	.079
	Intercept	PT2	.092	.112	.822	.411
	Slope	PT2	.307	.109	2.827	.005**
	Intercept	PT1	.238	.111	2.147	.032**
	Slope	PT1	.105	.106	.983	.325

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Intercept	PT4	-.128	.119	-1.078	.281
	Slope	PT4	.220	.114	1.927	.054
	Intercept	WK	.483	.125	3.853	<.001
	Slope	WK	.139	.120	1.157	.247
	Intercept	PC	.449	.125	3.579	<.001
	Slope	PC	-.047	.120	-.389	.697
	Intercept	AR	.416	.120	3.454	<.001
	Slope	AR	.166	.115	1.435	.151
11L	Intercept	PT3	.333	.118	2.820	.005**
	Slope	PT3	-.167	.115	-1.454	.146
	Intercept	PT2	.101	.112	.906	.365
	Slope	PT2	.293	.109	2.689	.007**
	Intercept	PT1	.226	.111	2.035	.042**
	Slope	PT1	.120	.108	1.111	.266
	Intercept	WK	.485	.125	3.878	<.001
	Slope	WK	.158	.121	1.302	.193
	Intercept	PC	.426	.125	3.418	<.001
	Slope	PC	-.022	.121	-.186	.852
	Intercept	AR	.260	.138	1.880	.060
	Slope	AR	.269	.135	1.999	.046**
	Intercept	MK	.233	.136	1.717	.086
	Slope	MK	-.092	.131	-.704	.482
11M	Intercept	PT3	.368	.116	3.167	.002**
	Slope	PT3	-.179	.112	-1.597	.110
	Intercept	PT2	.102	.112	.914	.361
	Slope	PT2	.291	.108	2.680	.007**
	Intercept	PT1	.236	.111	2.122	.034**
	Slope	PT1	.114	.107	1.066	.286
	Intercept	WK	.467	.125	3.744	<.001
	Slope	WK	.163	.120	1.362	.173
	Intercept	PC	.434	.125	3.481	<.001
	Slope	PC	-.024	.120	-.197	.844
	Intercept	AR	.386	.118	3.282	.001**
	Slope	AR	.218	.113	1.921	.055

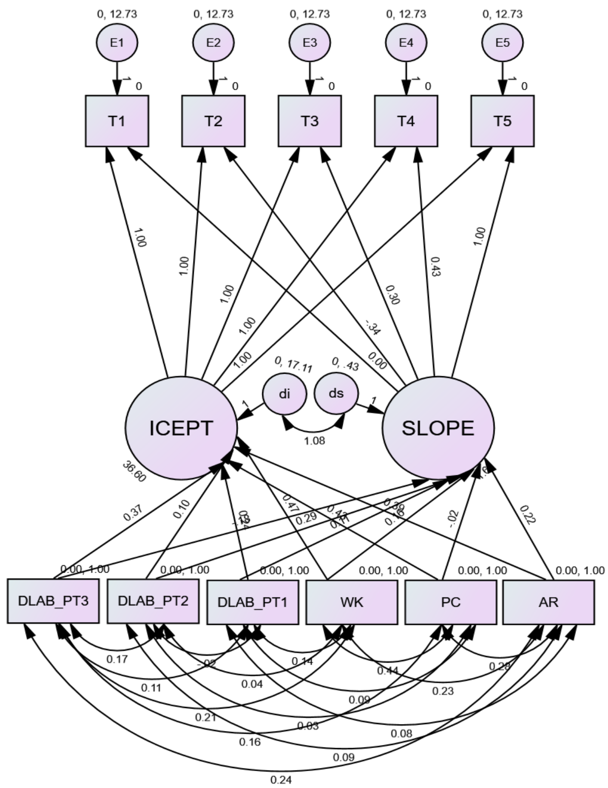
**p < .05

For the final model, 11M, (Figure 31), all residual variances were positive and significant (E1 = 12.727; SE = .270; CR = 47.123, p < .001; E2 = 12.727; SE = .270; CR = 47.123, p < .001;

E3 = 12.727; SE = .270; CR = 47.123, $p < .001$; E4 = 12.727; SE = .270; CR = 47.123, $p < .001$; E5 = 12.727; SE = .270; CR = 47.123, $p < .001$). 11M was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 51). ASVAB WK had the largest regression weight value for the intercept (.467), followed by ASVAB PC (.434), ASVAB AR (.386), DLAB PT3 (.368), and DLAB PT1 (.236).These results suggest that those participants who had higher scores on these subtests were more likely to have higher DLPT listening scores at graduation. The only subtest that had a significant predictive value for the slope was DLAB PT2 (.291), implying that those participants who had higher scores on the DLAB PT2 experienced slightly more growth in listening language proficiency (as measured by the DLPT) over the five test occasions. ASVAB MK was not found to be a significant predictor of the intercept or slope, so it was excluded from the final model. DLAB PT4 was a significant predictor of the slope until AR was entered into the model (Model 11K).

Figure 31

Path Diagram Persian Listening: Phase III Model 11M



Phase IV

The same dataset from Persian Listening Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 11M (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 52.

Table 52. Persian Listening Descriptive Statistics: Other predictors

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
GPA*	1654	3.46	.008	.332	.110	-.460	.060	-.344	.120
AGE*	1521	22.00	.083	3.246	10.534	1.106	.063	1.859	.125

EDUC*	1524	4.07	.052	2.047	4.189	.511	.063	-1.238	.125
TRN_HRS*	1010	389.12	8.353	265.454	70466.045	1.446	.077	3.261	.154
BILLET	1307	.42	.014	.494	.244	.308	.068	-1.908	.135
SEX	1735	.69	.011	.464	.215	-.810	.059	-1.345	.117

Descriptive statistics before standardization

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The predictors were entered in a specific order based on the limited amount of longitudinal research that exists that has examined the relationship between these predictors and language proficiency. The model fit statistics for all models are listed in Table 53, the parameter statistics are listed in Table 54, and the standardized regression weights are listed in Table 55.

Table 53. Persian Listening Model Fit Statistics: Other Predictors

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
11M	11L – MK	146.045	29	.000	.973	.002	.002 - .002
11N	11M +GPA	157.934	32	.000	.975	.002	.002 - .002
11O	11N – PT1 + AGE	153.363	32	.000	.977	.002	.002 - .002
11P	11O + EDUC	157.582	35	.000	.980	.002	.002 - .002
11Q	11O + TRN_HRS	164.223	35	.000	.975	.002	.002 - .002
11R	11O + BILLET	154.394	35	.000	.977	.002	.002 - .002
11S	11O + SEX	153.850	35	.000	.977	.002	.002 - .002

Table 54. Persian Listening Parameter Statistics: Other Predictors

		Intercept (I)	**Slope (S)**			
Model	***Model Variables***	***M***	***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
11M	11L – MK	36.596*	1.605*	17.112*	.430	1.085*
11N	11M + GPA	36.615*	1.624*	11.197*	.382	.805
11O	11N – PT1 + AGE	36.615*	1.622*	11.075*	.365	.835**
11P	11O + EDUC	36.609*	1.629*	11.047*	.355	.872**
11Q	11O + TRN_HRS	36.610*	1.638*	11.032*	.239	.824
11R	11O + BILLET	36.243*	1.459*	10.883*	.324	.775
11S	11O + SEX	36.337*	1.628*	11.046*	.362	.835**

*p < .001 **p < .05

Table 55. Persian Listening Standardized Regression Weights: Other Predictors

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
11N	Intercept	PT3	-.200	.102	-1.970	.049**
	Slope	PT3	-.200	.115	-1.737	.082
	Intercept	PT2	-.030	.096	-.317	.751
	Slope	PT2	.286	.109	2.630	.009**
	Intercept	PT1	-.144	.096	-1.503	.133
	Slope	PT1	.098	.108	.906	.365
	Intercept	WK	.324	.106	3.048	.002**
	Slope	WK	.164	.121	1.362	.173
	Intercept	PC	.325	.106	3.056	.002**
	Slope	PC	-.026	.120	-.215	.830
	Intercept	AR	.249	.100	2.484	.013**
	Slope	AR	.215	.114	1.884	.060
	Intercept	GPA	2.587	.100	25.869	<.001
	Slope	GPA	.119	.115	1.035	.301
11O	Intercept	PT3	-.231	.101	-2.275	.023**
	Slope	PT3	-.189	.115	-1.641	.101
	Intercept	PT2	-.001	.095	-.014	.988
	Slope	PT2	.277	.109	2.542	.011**
	Intercept	WK	.439	.112	3.923	<.001
	Slope	WK	.137	.127	1.079	.281
	Intercept	PC	.333	.106	3.145	.002**
	Slope	PC	-.026	.120	-.215	.829
	Intercept	AR	.272	.100	2.713	.007**
	Slope	AR	.210	.114	1.838	.066
	Intercept	GPA	2.530	.099	25.534	<.001
	Slope	GPA	.141	.114	1.235	.217
	Intercept	AGE	-.377	.107	-3.529	<.001
	Slope	AGE	.102	.121	.839	.402
11P	Intercept	PT3	-.230	.101	-2.272	.023**
	Slope	PT3	-.190	.116	-1.638	.101
	Intercept	PT2	-.012	.096	-.124	.901
	Slope	PT2	.285	.110	2.594	.009**
	Intercept	WK	.446	.112	3.972	<.001
	Slope	WK	.131	.128	1.021	.307
	Intercept	PC	.331	.106	3.121	.002**
	Slope	PC	-.025	.121	-.209	.835
	Intercept	AR	.269	.100	2.684	.007**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	AR	.212	.115	1.853	.064
	Intercept	GPA	2.541	.100	25.537	<.001
	Slope	GPA	.132	.115	1.149	.250
	Intercept	AGE	-.266	.139	-1.918	.055
	Slope	AGE	.036	.158	.226	.822
	Intercept	EDUC	-.155	.135	-1.150	.250
	Slope	EDUC	.104	.154	.677	.499
11Q	Intercept	PT3	-.227	.101	-2.243	.025**
	Slope	PT3	-.193	.117	-1.655	.098
	Intercept	PT2	.006	.096	.061	.951
	Slope	PT2	.296	.110	2.684	.007**
	Intercept	WK	.442	.112	3.949	<.001
	Slope	WK	.147	.129	1.144	.253
	Intercept	PC	.331	.106	3.125	.002**
	Slope	PC	-.027	.122	-.220	.826
	Intercept	AR	.298	.102	2.932	.003**
	Slope	AR	.242	.117	2.075	.038**
	Intercept	GPA	2.524	.099	25.454	<.001
	Slope	GPA	.137	.115	1.191	.234
	Intercept	AGE	-.400	.108	-3.711	<.001
	Slope	AGE	.067	.124	.543	.587
	Intercept	TRN_HRS	.202	.123	1.636	.102
	Slope	TRN_HRS	.247	.134	1.853	.064
11R	Intercept	PT3	-.232	.101	-2.299	.022**
	Slope	PT3	-.186	.116	-1.608	.108
	Intercept	PT2	.012	.095	.126	.900
	Slope	PT2	.283	.109	2.590	.010**
	Intercept	WK	.427	.111	3.828	<.001
	Slope	WK	.132	.127	1.035	.301
	Intercept	PC	.319	.106	3.017	.003**
	Slope	PC	-.033	.121	-.270	.787
	Intercept	AR	.320	.101	3.174	.002**
	Slope	AR	.230	.115	1.995	.046**
	Intercept	GPA	2.555	.099	25.822	<.001
	Slope	GPA	.146	.114	1.280	.200
	Intercept	AGE	-.386	.106	-3.632	<.001
	Slope	AGE	.105	.121	.867	.386
	Intercept	BILLET	.862	.217	3.975	<.001

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	BILLET	.390	.240	1.625	.104
11S	Intercept	PT3	-.221	.101	-2.176	.030**
	Slope	PT3	-.189	.115	-1.639	.101
	Intercept	PT2	.004	.095	.044	.965
	Slope	PT2	.277	.109	2.543	.011**
	Intercept	WK	.430	.112	3.841	<.001
	Slope	WK	.137	.127	1.080	.280
	Intercept	PC	.322	.106	3.036	.002**
	Slope	PC	-.026	.120	-.219	.826
	Intercept	AR	.233	.102	2.286	.022**
	Slope	AR	.210	.116	1.807	.071
	Intercept	GPA	2.536	.099	25.600	<.001
	Slope	GPA	.141	.114	1.239	.215
	Intercept	AGE	-.380	.107	-3.567	<.001
	Slope	AGE	.103	.121	.846	.397
	Intercept	SEX	.405	.206	1.967	.049**
	Slope	SEX	-.007	.234	-.031	.975

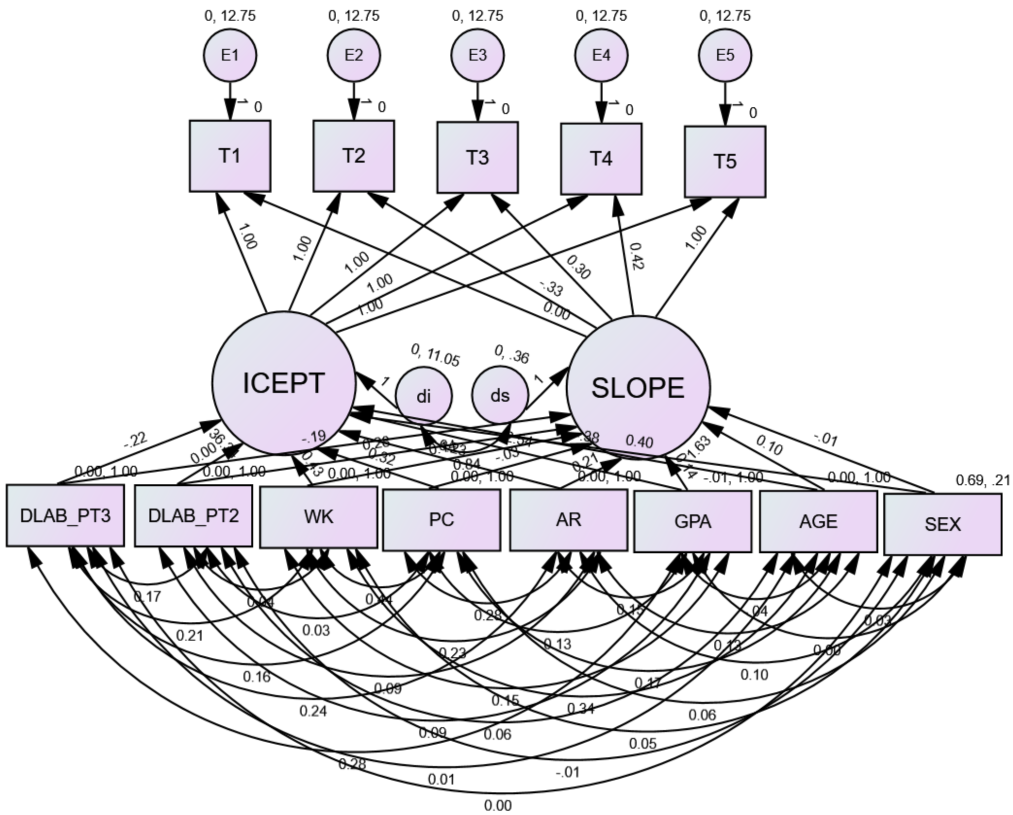
**p < .05

For the final model, 11S, (Figure 32), all residual variances were positive and significant (E1 = 12.747; SE = .270; CR = 47.185, p < .001; E2 = 12.747; SE = .270; CR = 47.185, p < .001; E3 = 12.747; SE = .270; CR = 47.185, p < .001; E4 = 12.747; SE = .270; CR = 47.185, p < .001; E5 = 12.747; SE = .270; CR = 47.185, p < .001). 11S was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 55). GPA had the largest significant regression weight on the intercept (2.536), followed by ASVAB WK (.430), SEX (.405), PC (.322), and ASVAB AR (.233). These results suggest that those participants who had higher GPAs at DLI, had higher scores on the WK and PC and AR ASVAB subtests, and were male, were more likely to have higher DLPT listening scores at graduation. ASVAB PT3 (-.221) and AGE (-.380) had negative significant regression weights on the intercept; these results imply that those who had higher scores on the PT3 subtest and those who were older while attending DLI did not do as well on the DLPT at graduation. The only predictor that had a significant predictive value for the slope was DLAB PT2 (.277), implying that those participants who had higher scores on the PT2 subtest experienced slightly more growth in listening language proficiency (as measured by the DLPT) over the five test occasions. EDUC and TRN_HRS were not found to be significant predictors of the intercept or slope in the analysis (see Table 65). BILLET was found to be a significant predictor of the intercept; however, this result is not meaningful as participants are not assigned their billet types until after they attend DLI. BILLET was not found to be a significant predictor of the slope. There was a significant covariance between several of the predictors (see Table 66). The predictive value of the predictors that covary with GPA (PT3, PT2, WK, PC, AR) were likely reduced because GPA was the strongest predictor of the intercept.

The results from Phases II, III, and IV for the Persian DLPT listening suggest that the participants' GPA had the largest positive impact on their performance on the DLPT listening at graduation. The participants whose performance on the ASVAB WK, ASVAB PC, ASVAB AR was higher were more likely to perform better on the DLPT listening at graduation. The results imply that those participants with higher GPAs and higher scores on the WK, PC, and AR subtests performed better. However, the results also suggest that those participants who had higher scores on the DLAB PT3 and who were older did not perform as well on the DLPT listening at graduation and that those participants who scored higher on the DLAB PT2 experienced more growth in language proficiency over the five DLPT listening test occasions.

Figure 32

Path Diagram Persian Listening: Phase IV Model 11S



Persian Reading

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Persian DLPT reading was 1030 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Persian reading sample are shown in Table 56. 78.9% of the sample had four test occasions, and 55.9% had five test occasions. Figure 33 displays the mean DLPT listening scores at each test occasion. The average listening proficiency decreased between Time1 and Time2 but then increased from one test occasion to the next. The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Persian reading scores at all test occasions are slightly negatively skewed and that the scores are slightly leptokurtic.

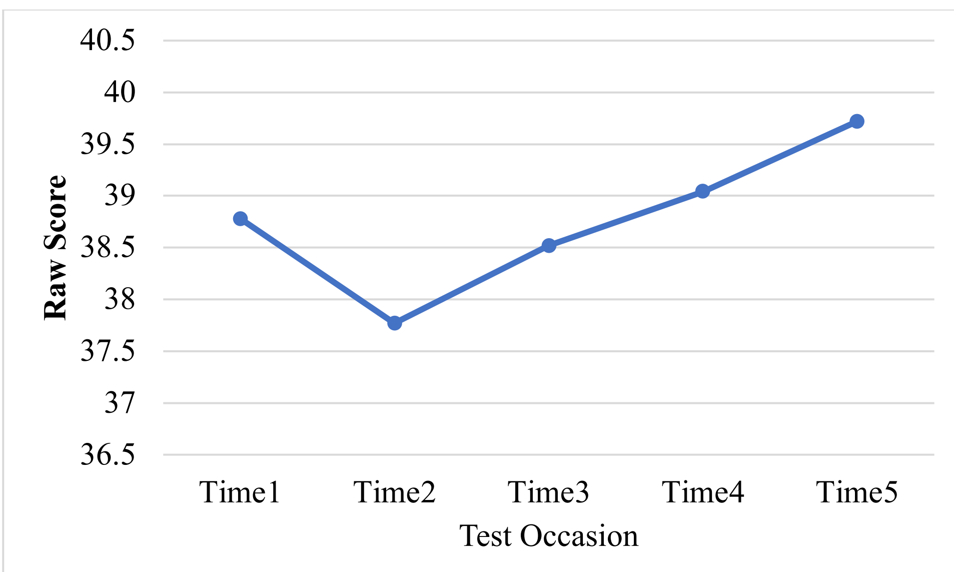
Table 56. Persian Reading Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	1030	38.78	.146	4.697	22.060	-.667	.076	1.175	.152
Time2	1030	37.77	.166	5.342	28.539	-.442	.076	.470	.152
Time3	1030	38.52	.167	5.345	28.568	-.596	.076	.403	.152
Time4	813	39.04	.183	5.214	27.185	-.626	.086	.585	.171
Time5	576	39.72	.202	4.836	23.387	-.600	.102	.494	.203
APT*	1030	112.53	.307	9.856	97.147	.931	.076	.996	.152
COG*	1030	89.71	.252	8.088	65.423	-1.176	.076	1.335	.152
ATT*	866	3.51	.032	.939	.881	-.265	.083	.459	.166

Descriptive statistics before standardization

Figure 33

Mean DLPT Reading Scores by Test Occasion: Persian



Two growth models, linear and non-linear were compared. The linear model, Model 12AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 12A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 12A indicated a better model fit (χ^2= 111.688, *df* = 13, *p* = .00; CFI = .940; RMSEA = .003, CI = .002-.003) than Model 12AA (χ^2= 166.899, *df* = 16 , *p* = .00; CFI = .908; RMSEA = .003, CI = .003-.003). Therefore, Model 12A was accepted as the base model.

For Model 12A, the mean slope was positive and significant (*M* = 1.283, $p < .001$) indicating that the Persian DLPT reading scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 38.588, $p < .001$). The covariance between the slope and the intercept was set to a constant, 1.0. The slope variance set to a constant, 1.0, so that the model would converge. The intercept variance (14.797, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial Persian DLPT Reading score. Table 58 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Language Difficulty Category III languages (See Chapter 5). The model fit statistics for all models are listed in Table 57, the parameter statistics are listed in Table 58, and the standardized regression weights are listed in Table 59.

Table 57. Persian Reading Model Fit Statistics

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
12A	Base	111.688	13	.000	.940	.003	.002 - .003
12B	12A + APT	112.098	16	.000	.943	.002	.002 - .003
12C	12B + COG	113.580	19	.000	.949	.002	.002 - .003
12D	12C + ATT	120.358	22	.000	.948	.002	.002 - .002

Table 58. Persian Reading Parameter Statistics

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
12A	Base	38.588*	1.283*	14.797*	1.00	1.0
12B	12A + APT	38.592*	1.272*	13.800*	1.00	1.0
12C	12B + COG	38.588*	1.278*	12.682*	1.00	1.0
12D	12C + ATT	38.586*	1.273*	12.592*	1.00	1.0

*p < .001 **p < .05

Table 59. Persian Reading Standardized Regression Weights

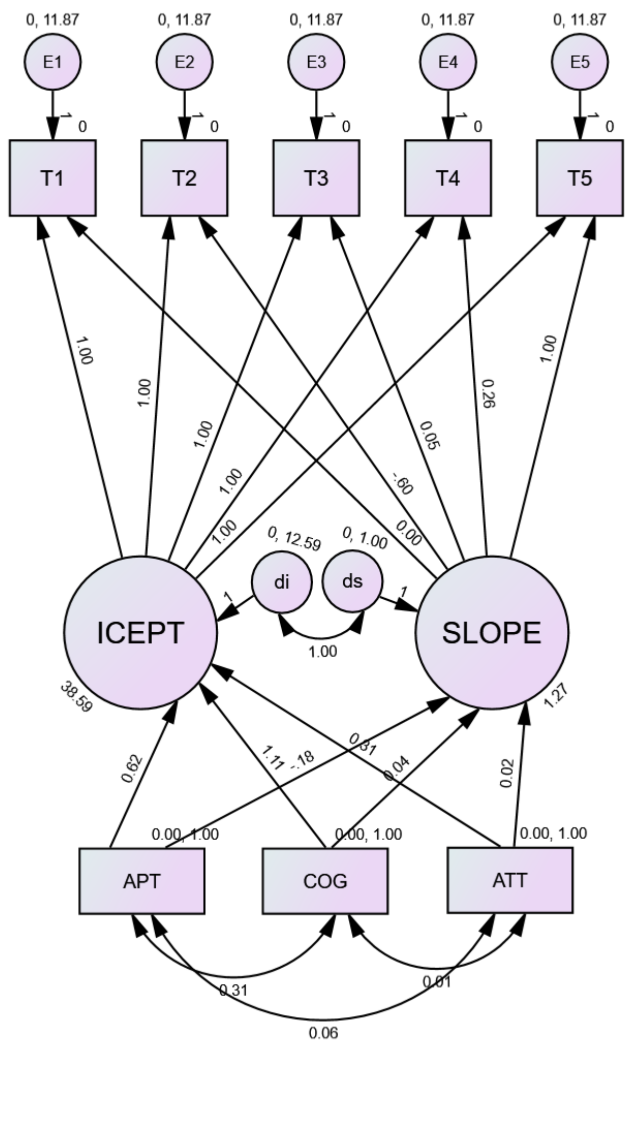
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
12B	Intercept	APT	.990	.128	7.755	< .001
	Slope	APT	-.162	.120	-1.351	.177
12C	Intercept	APT	.645	.130	4.963	< .001
	Slope	APT	-.173	.127	-1.363	.173
	Intercept	COG	1.104	.129	8.533	< .001
	Slope	COG	.000	.106	-.003	.998
12D	Intercept	APT	.625	.130	4.809	< .001
	Slope	APT	-.175	.127	-1.383	.167
	Intercept	COG	1.107	.129	8.569	< .001
	Slope	COG	.041	.125	.326	.745
	Intercept	ATT	.308	.134	2.299	.022**
	Slope	ATT	.025	.130	.191	.849

**p < .05

For the final model, Model 12D (Figure 34), the residual variances were all positive and significant (E1 = 11.869; *SE* = .295, CR = 40.239, $p < .001$; E2 = 11.869; *SE* = .295, CR = 40.239, $p < .001$; E3 = 11.869; *SE* = .295, CR = 40.239, $p < .001$; E4 = 11.869; *SE* = .295, CR = 40.239, $p < .001$; E5 = 11.869; *SE* = .295, CR = 40.239, $p < .001$). APT, COG, and ATT were significant predictors of the intercept; general cognitive ability, language aptitude, and attitude towards learning predicted the initial Persian Reading scores. The covariance between APT and COG is also significant, so even though the prediction value of APT on the intercept decreases from one model to the next (see Table 59) this is likely due to COG being entered into the models. Interestingly, COG was a stronger predictor than APT. This goes against the prediction that APT would have more predictive value for DLI Language Difficulty Category III languages. None of the predictors were significant predictors of the slope. This may be because although the mean slope was significant, there was a limited amount of growth in the Persian reading population.

Figure 34

Path Diagram Persian Reading: Phase II Model 12D



Phase III

The same dataset from Persian Reading Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 60.

Table 60. Persian Reading Descriptive Statistics: ASVAB and DLAB Subtests

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
ASVAB_WK*	1030	61.15	.186	5.970	35.635	.062	.076	-.141	.152
ASVAB_PC*	1030	61.32	.149	4.775	22.802	-.497	.076	-.055	.152
ASVAB_AR*	1030	61.88	.159	5.107	26.085	-.246	.076	-.128	.152
ASVAB_MK*	1030	62.53	.149	4.796	23.006	-.060	.076	-.356	.152
DLAB_PT1*	1030	3.07	.048	1.526	2.330	.181	.076	-.519	.152
DLAB_PT2*	1030	12.37	.093	3.000	8.998	-.313	.076	-.485	.152
DLAB_PT3*	1030	44.66	.165	5.294	28.023	.210	.076	-.019	.152
DLAB_PT4*	1030	18.54	.124	3.991	15.926	-.215	.076	.055	.152

Descriptive statistics before standardization

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for DLI Language Difficulty Category III languages. The subtests were entered in the same order as they were for the Persian listening analysis. When a subtest was not a significant predictor, it was excluded from the next model. The model fit statistics for all models are listed in Table 61, the parameter statistics are listed in Table 62, and the standardized regression weights are listed in Table 63. ASVAB subtests and DLAB subtests are abbreviated in the tables: ASVAB WK (WK), ASVAB PC (PC), ASVAB AR (AR), ASVAB MK (MK), DLAB PT 1 (PT1), DLAB PT2 (PT2), DLAB PT3 (PT3), DLAB PT4 (PT4).

Table 61. Persian Reading Model Fit Statistics: ASVAB and DLAB Subtests

Model	*Model Variables*	χ^2	*df*	*p*	CFI	RMSEA	CI
12A	Base	111.688	13	.000	.940	.003	.002 - .003

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
12E	12A + PT3	153.766	16	.000	.918	.003	.002 - .003
12F	12E + PT2	158.072	19	.000	.917	.003	.002 - .003
12G	12E + PT1	155.825	19	.000	.919	.003	.002 - .003
12H	12G + PT4	157.691	22	.000	.921	.002	.002 - .003
12I	12H + WK	162.849	25	.000	.925	.002	.002 - .003
12J	12I + PC	162.250	28	.000	.937	.002	.002 - .002
12K	12J + AR	166.655	31	.000	.941	.002	.002 - .002
12L	12J + MK	164.279	31	.000	.941	.002	.002 - .002
12M	12L – PT4 + ATT	167.173	31	.000	.937	.002	.002 - .002

Table 62. Persian Reading Parameter Statistics: ASVAB and DLAB Subtests

		Intercept (I)	**Slope (S)**			
Model	***Model Variables***	***M***	***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
12A	Base	38.588*	1.283*	14.797*	1.00	1.00
12E	12A + PT3	39.157*	-.445*	10.642*	1.00	1.00
12F	12E + PT2	39.152*	-.451*	10.656*	1.00	1.00
12G	12E + PT1	39.154*	-.458*	10.476*	1.00	1.00
12H	12G + PT4	39.154*	-.459*	10.172*	1.00	1.00
12I	12H + WK	39.148*	-.464*	9.344*	1.00	1.00
12J	12I + PC	39.149*	-.464*	9.044*	1.00	1.00
12K	12J + AR	39.144*	-.459*	8.956*	1.00	1.00
12L	12J + MK	39.148*	-.465*	8.899*	1.00	1.00
12M	12L – PT4 + ATT	39.146*	-.468	8.890*	1.00	1.00

*p < .001 **p < .05

Table 63. Persian Reading Standardized Regression Weights: ASVAB and DLAB Subtests

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
12E	Intercept	PT3	.714	.141	5.070	< .001
	Slope	PT3	.017	.077	.224	.822
12F	Intercept	PT3	.722	.142	5.096	< .001
	Slope	PT3	.008	.077	.108	.914
	Intercept	PT2	-.068	.142	-.480	.631
	Slope	PT2	.077	.078	.989	.323
12G	Intercept	PT3	.697	.140	4.964	< .001
	Slope	PT3	.007	.078	.092	.927
	Intercept	PT1	.322	.141	2.292	.022*
	Slope	PT1	.177	.080	2.213	.027
12H	Intercept	PT3	.657	.140	4.689	< .001

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	PT3	.004	.079	.052	.959
	Intercept	PT1	.310	.140	2.216	.027*
	Slope	PT1	.176	.080	2.202	.028*
	Intercept	PT4	.519	.140	3.711	< .001
	Slope	PT4	.035	.079	.448	.654
12I	Intercept	PT3	.536	.139	3.852	< .001
	Slope	PT3	-.018	.082	-.217	.828
	Intercept	PT1	.238	.138	1.725	.084
	Slope	PT1	.168	.082	2.041	.041*
	Intercept	PT4	.372	.140	2.665	.008
	Slope	PT4	.011	.082	.129	.897
	Intercept	WK	.828	.142	5.835	< .001
	Slope	WK	.143	.084	1.704	.088
12J	Intercept	PT3	.512	.138	3.713	< .001
	Slope	PT3	-.015	.081	-.186	.853
	Intercept	PT1	.230	.137	1.685	.092
	Slope	PT1	.168	.082	2.055	.040
	Intercept	PT4	.278	.140	1.987	.047
	Slope	PT4	.020	.083	.243	.808
	Intercept	WK	.531	.156	3.417	< .001
	Slope	WK	.173	.093	1.860	.063
	Intercept	PC	.687	.155	4.432	< .001
	Slope	PC	-.070	.092	-.759	.448
12K	Intercept	PT3	.488	.140	3.491	< .001
	Slope	PT3	-.035	.083	-.420	.675
	Intercept	PT1	.229	.137	1.679	.093
	Slope	PT1	.169	.082	2.049	.040**
	Intercept	PT4	.239	.145	1.652	.098
	Slope	PT4	-.012	.086	-.136	.892
	Intercept	WK	.522	.156	3.348	< .001
	Slope	WK	.166	.094	1.778	.075
	Intercept	PC	.659	.157	4.197	< .001
	Slope	PC	-.091	.093	-.969	.333
	Intercept	AR	.167	.148	1.133	.257
	Slope	AR	.130	.088	1.468	.142
12L	Intercept	PT3	.414	.141	2.928	.003**
	Slope	PT3	-.019	.084	-.223	.823
	Intercept	PT1	.208	.136	1.528	.127

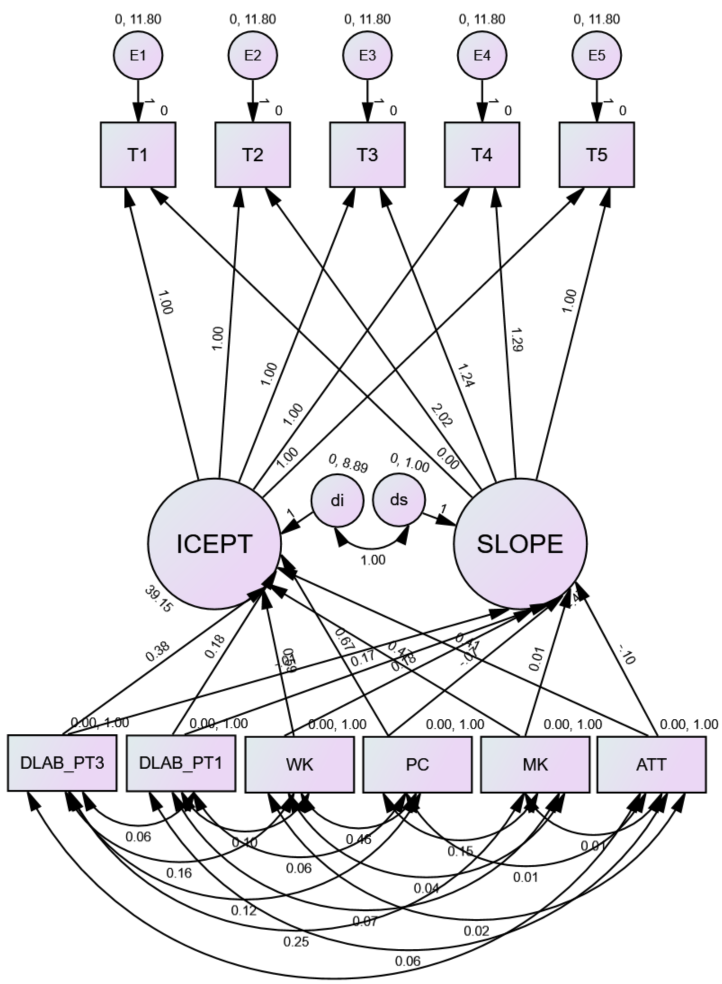
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	PT1	.168	.082	2.046	.041**
	Intercept	PT4	.188	.143	1.318	.187
	Slope	PT4	.017	.085	.199	.842
	Intercept	WK	.573	.155	3.683	< .001
	Slope	WK	.175	.093	1.874	.061
	Intercept	PC	.640	.155	4.128	< .001
	Slope	PC	-.072	.092	-.778	.437
	Intercept	MK	.421	.144	2.917	.004**
	Slope	MK	.014	.086	.168	.866
12M	Intercept	PT3	.377	.141	2.669	.008**
	Slope	PT3	-.010	.084	-.120	.905
	Intercept	PT2	.185	.136	1.357	.175
	Slope	PT2	.174	.082	2.121	.034**
	Intercept	PT1	.594	.154	3.856	< .001
	Slope	PT1	.179	.093	1.933	.053
	Intercept	WK	.667	.153	4.352	< .001
	Slope	WK	-.071	.091	-.774	.439
	Intercept	PC	.474	.141	3.371	< .001
	Slope	PC	.013	.083	.156	.876
	Intercept	MK	.406	.147	2.755	.006**
	Slope	MK	-.097	.088	-1.109	.268
	Intercept	ATT	.377	.141	2.669	.008**
	Slope	ATT	-.010	.084	-.120	.905

**p < .05

For the final model, 12M, (Figure 35), all residual variances were positive and significant (E1 = 11.802; SE = .299; CR = 39.446, $p < .001$; E2 = 11.802; SE = .299; CR = 39.446, $p < .001$; E3 = 11.802; SE = .299; CR = 39.446, $p < .001$; E4 = 11.802; SE = .299; CR = 39.446, $p < .001$; E5 = 11.802; SE = .299; CR = 39.446, $p < .001$). 12M was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 63). ASVAB PC had the largest regression weight value for the intercept (.667), followed by ASVAB WK (.594), ASVAB MK (.474), ATT (.406), and DLAB PT3 (.377). These results suggest that those participants who had higher scores on these subtests and who had a more positive (higher) attitude towards learning the language they were assigned to were more likely to have higher DLPT reading scores at graduation. The only subtest that had a significant predictive value for the slope was DLAB PT1 (.174), implying that those participants who had higher scores on the DLAB PT1 experienced slightly more growth in reading language proficiency (as measured by the DLPT) over the five test occasions.

Figure 35

Path Diagram Persian Reading: Phase III Model 12M



Phase IV

The same dataset from Persian Listening Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 12M (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 64.

Table 64. Persian Reading Descriptive Statistics: Other predictors

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
GPA*	980	3.45	.011	.339	.115	-.418	.078	-.452	.156
AGE*	862	22.07	.160	4.687	21.970	9.974	.083	182.879	.166
EDUC*	862	4.05	.069	2.034	4.137	.542	.083	-1.158	.166
TRN_HRS*	591	409.57	10.963	266.515	71030.175	1.393	.101	3.647	.201
BILLET	762	.43	.018	.496	.246	.265	.089	-1.935	.177
SEX	1030	.67	.015	.472	.222	-.710	.076	-1.499	.152

Descriptive statistics before standardization

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The predictors were entered in a specific order based on the limited amount of longitudinal research that exists that has examined the relationship between these predictors and language proficiency. The model fit statistics for all models are listed in Table 65, the parameter statistics are listed in Table 66, and the standardized regression weights are listed in Table 67.

Table 65. Persian Reading Model Fit Statistics: Other Predictors

Model	*Model Variables*	χ^2	*df*	*p*	CFI	RMSEA	CI
12M	12L – PT4 + ATT	167.173	31	.000	.937	.002	.002 - .002
12N	12M +GPA	174.688	34	.000	.947	.002	.002 - .002
12O	12N – PT3, PT1 + AGE	175.056	31	.000	.943	.002	.002 - .002
12P	12O – AGE + EDUC	172.573	31	.000	.945	.002	.002 - .002
12Q	12P + TRN_HRS	182.838	34	.000	.943	.002	.002 - .002
12R	12P + BILLET	174.547	34	.000	.946	.002	.002 - .002
12S	12R + SEX	176.005	37	.000	.948	.002	.002 - .002

Table 66. Persian Reading Parameter Statistics: Other Predictors

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
12M	12L – PT4 + ATT	39.146*	-.468*	8.890*	1.00	1.00
12N	12M + GPA	39.141*	-.468*	4.146*	1.00	1.00
12O	12N – PT3, PT1 + AGE	39.144*	-.467*	4.138*	1.00	1.00
12P	12O – AGE + EDUC	39.143*	-.472*	4.176*	1.00	1.00
12Q	12P + TRN_HRS	39.140*	-.469	4.169*	1.00	1.00
12R	12P + BILLET	39.111*	-.656*	4.154*	1.00	1.00
12S	12R + SEX	38.780*	-.614	4.119*	1.00	1.00

*p < .001 **p < .05

Table 67. Persian Reading Standardized Regression Weights: Other Predictors

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
12N	Intercept	PT3	-.094	.129	-.729	.466
	Slope	PT3	-.058	.094	-.617	.537
	Intercept	PT1	-.076	.122	-.626	.531
	Slope	PT1	.166	.090	1.849	.064
	Intercept	WK	.459	.137	3.357	< .001
	Slope	WK	.183	.101	1.815	.070
	Intercept	PC	.510	.136	3.742	< .001
	Slope	PC	-.088	.100	-.876	.381
	Intercept	MK	.287	.125	2.293	.022**
	Slope	MK	.008	.091	.092	.927
	Intercept	ATT	.282	.131	2.154	.031**
	Slope	ATT	-.110	.096	-1.142	.253
	Intercept	GPA	2.190	.128	17.067	< .001
	Slope	GPA	.174	.096	1.821	.069
12O	Intercept	WK	.455	.138	3.298	< .001
	Slope	WK	.167	.101	1.645	.100
	Intercept	PC	.514	.137	3.744	< .001
	Slope	PC	-.095	.100	-.951	.342
	Intercept	MK	.261	.122	2.135	.033**
	Slope	MK	.006	.089	.069	.945
	Intercept	GPA	.270	.131	2.064	.039**
	Slope	GPA	-.109	.096	-1.134	.257
	Intercept	AGE	2.154	.125	17.242	< .001

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	AGE	.191	.093	2.052	.040**
12P	Intercept	WK	.495	.142	3.475	< .001
	Slope	WK	.096	.105	.913	.361
	Intercept	PC	.505	.137	3.694	< .001
	Slope	PC	-.082	.100	-.812	.417
	Intercept	MK	.261	.122	2.138	.033**
	Slope	MK	.008	.090	.092	.927
	Intercept	ATT	.276	.131	2.111	.035**
	Slope	ATT	-.118	.096	-1.229	.219
	Intercept	GPA	2.157	.125	17.317	< .001
	Slope	GPA	.188	.094	2.014	.044**
	Intercept	EDUC	-.166	.138	-1.205	.228
	Slope	EDUC	.292	.104	2.812	.005**
12Q	Intercept	WK	.494	.143	3.467	< .001
	Slope	WK	.097	.105	.923	.356
	Intercept	PC	.504	.137	3.685	< .001
	Slope	PC	-.081	.101	-.801	.423
	Intercept	MK	.259	.123	2.112	.035**
	Slope	MK	.011	.090	.122	.903
	Intercept	ATT	.276	.132	2.100	.036**
	Slope	ATT	-.123	.097	-1.267	.205
	Intercept	GPA	2.158	.125	17.304	< .001
	Slope	GPA	.188	.094	2.005	.045**
	Intercept	EDUC	-.166	.138	-1.199	.230
	Slope	EDUC	.289	.104	2.772	.006**
	Intercept	TRN_HRS	-.033	.159	-.208	.835
	Slope	TRN_HRS	.043	.117	.369	.712
12R	Intercept	WK	.493	.143	3.459	< .001
	Slope	WK	.098	.106	.921	.357
	Intercept	PC	.502	.137	3.666	< .001
	Slope	PC	-.092	.102	-.904	.366
	Intercept	MK	.264	.123	2.152	.031**
	Slope	MK	.019	.091	.206	.837
	Intercept	ATT	.270	.132	2.040	.041**
	Slope	ATT	-.146	.099	-1.473	.141
	Intercept	GPA	2.163	.125	17.237	< .001
	Slope	GPA	.207	.095	2.165	.030**
	Intercept	EDUC	-.171	.138	-1.234	.217

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	EDUC	.281	.105	2.676	.007**
	Intercept	BILLET	.053	.285	.185	.853
	Slope	BILLET	.434	.215	2.016	.044**
12S	Intercept	WK	.469	.143	3.274	.001**
	Slope	WK	.099	.106	.933	.351
	Intercept	PC	.480	.137	3.499	< .001
	Slope	PC	-.090	.102	-.880	.379
	Intercept	MK	.246	.123	2.001	.045**
	Slope	MK	.021	.091	.231	.817
	Intercept	ATT	.277	.132	2.092	.036**
	Slope	ATT	-.144	.099	-1.458	.145
	Intercept	GPA	2.175	.125	17.337	< .001
	Slope	GPA	.204	.095	2.136	.033**
	Intercept	EDUC	-.154	.138	-1.116	.264
	Slope	EDUC	.282	.105	2.679	.007**
	Intercept	BILLET	.121	.286	.425	.671
	Slope	BILLET	.415	.216	1.925	.054
	Intercept	SEX	.456	.261	1.745	.081
	Slope	SEX	-.051	.194	-.265	.791

**$p < .05$

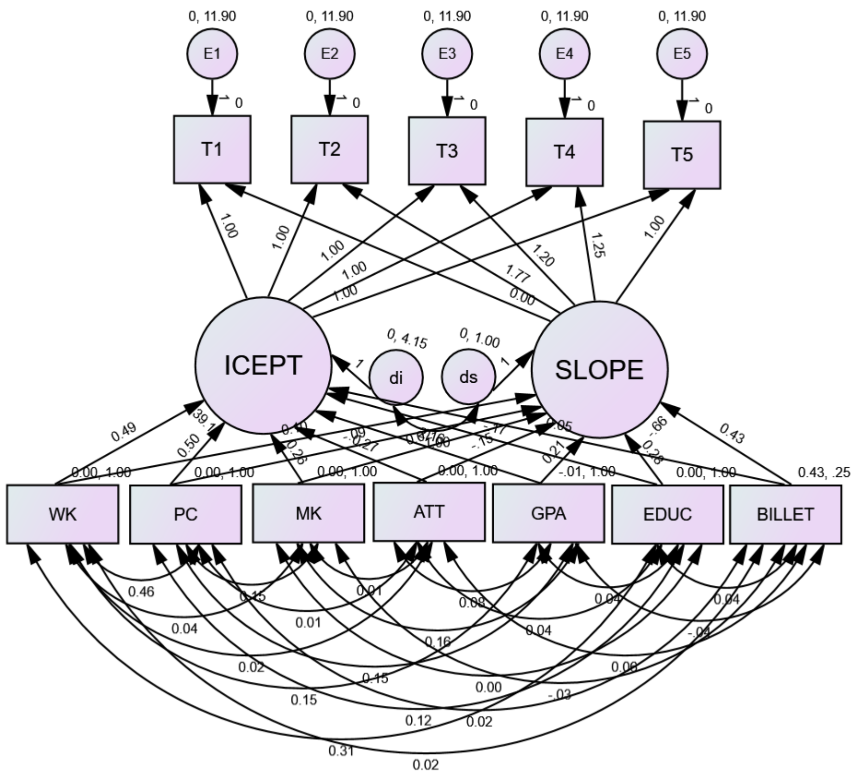
For the final model, 12R, (Figure 36), all residual variances were positive and significant (E1 = 11.899; SE = .295; CR = 40.282, $p < .001$; E2 = 11.899; SE = .295; CR = 40.282, $p < .001$; E3 = 11.899; SE = .295; CR = 40.282, $p < .001$; E4 = 11.899; SE = .295; CR = 40.282, $p < .001$; E5 = 11.899; SE = .295; CR = 40.282, $p < .001$). 12R was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 67). GPA had the largest significant regression weight on the intercept (2.163), followed by ASVAB PC (.502), ASVAB WK (.493), ATT (.270), and ASVAB MK (.264). These results suggest that those participants who had higher GPAs at DLI, had higher scores on the PC, WK, and MK ASVAB subtests, and who had more positive attitudes (higher scores) towards learning their assigned language were more likely to have higher DLPT listening scores at graduation.

BILLET had the highest significant regression weight on the slope (.434) followed by EDUC (.281) and GPA (.207), implying that those participants who were assigned to a DOD (not military) billet, who started their training at DLI with a higher level of education, and those who had a higher GPA at DLI experienced slightly more growth in reading language proficiency (as measured by the DLPT) over the five test occasions. AGE, TRN_HOURS, and SEX were not found to be significant predictors of the intercept or slope in the analysis (see Table 67). BILLET was found to be a significant predictor of the intercept; however, this result is not meaningful as participants are not assigned their billet types until after they attend DLI. There was a significant covariance between several of the predictors (see Appendix). The predictive value of the predictors that covary with GPA (WK, PC, MK) were likely reduced because GPA was the strongest predictor of the intercept.

The results from Phases II, III, and IV for the Persian DLPT reading suggest that the participants' GPA had the largest positive impact on their performance on the DLPT reading at graduation with those participants with higher GPAs performing better. The participants whose performance was better on the ASVAB WK, ASVAB PC, ASVAB AR were more likely to perform better on the DLPT reading at graduation. The results also suggest that those participants who started their language training at DLI with a higher level of education and those who had higher GPAs at DLI experienced more growth in language proficiency over the five DLPT reading test occasions.

Figure 36

Path Diagram Persian Reading: Phase IV Model 12R



Russian Listening

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Russian DLPT listening was 700 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Russian listening sample are shown in Table 68. 76.8% of the sample had four test occasions, and 56.1% had five test occasions. Figure 37 displays the mean DLPT listening scores at each test occasion. The average listening proficiency decreased between Time1 and Time2 but then increased from one test occasion to the next The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Russian listening scores at all test occasions except Time2 are slightly negatively skewed and that the scores are slightly platykurtic.

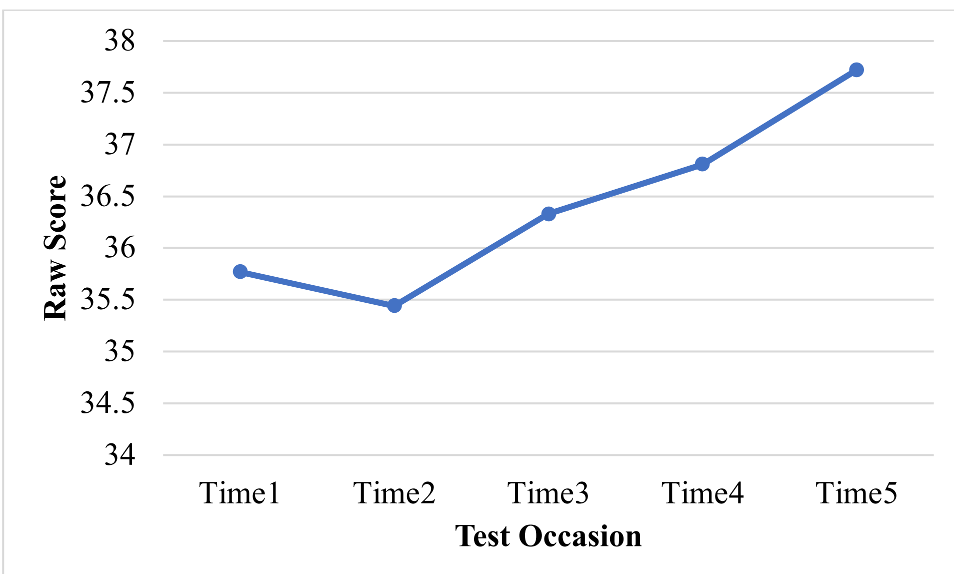
Table 68. Russian Listening Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	700	35.77	.224	5.919	35.034	-.230	.092	-.070	.185
Time2	700	35.44	.219	5.792	33.549	.073	.092	-.211	.185
Time3	700	36.33	.226	5.983	35.797	-.105	.092	-.194	.185
Time4	538	36.81	.250	5.794	33.567	-.042	.105	-.349	.210
Time5	393	37.72	.283	5.618	31.565	-.216	.123	-.093	.246
APT*	700	115.50	.467	12.354	152.617	.587	.092	.113	.185
COG*	700	90.09	.321	8.486	72.014	-1.366	.092	1.812	.185
ATT*	660	4.37	.034	.862	.743	-1.132	.095	.531	.190

***Descriptive statistics before standardization**

Figure 37

Mean DLPT Listening Scores by Test Occasion: Russian



Two growth models, linear and non-linear were compared. The linear model, Model 13AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 13A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 13A indicated a better model fit (χ^2= 61.983, *df* = 13, *p* = .00; CFI = .969; RMSEA = .002, CI = .001-.002) than Model 13AA (χ^2= 78.656, *df* = 16 , *p* = .00; CFI = .960; RMSEA = .002, CI = .002-.002). Therefore, Model 13A was accepted as the base model.

For Model 13A, the mean slope was positive and significant (*M* = 1.827, $p < .001$) indicating that the Russian DLPT listening scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 35.701, $p < .001$). The covariance between the slope and the intercept was set to 1.0. The slope variance was set to a constant, 1.0, so that the model would converge. The intercept variance (21.405, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial Russian DLPT Listening score. Table 70 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Language Category III languages (See Chapter 5). The model fit statistics for all models are listed in Table 69, the parameter statistics are listed in Table 70, and the standardized regression weights are listed in Table 71.

Table 69. Russian Listening Model Fit Statistics

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
13A	Base	61.983	13	.000	.969	.002	.001 - .002
13B	13A + APT	63.060	16	.000	.971	.002	.001 - .002

Model	*Model Variables*	χ^2	*df*	*p*	CFI	RMSEA	CI
13C	13B + COG	67.109	19	.000	.973	.002	.001 - .002
13D	13C + ATT	77.756	22	.000	.969	.002	.001 - .002

Table 70. Russian Listening Parameter Statistics

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
13A	Base	35.701*	1.827*	21.405*	1.00	1.00
13B	13A + APT	35.694*	1.856*	20.717*	1.00	1.00
13C	13B + COG	35.696*	1.849*	20.068*	1.00	1.00
13D	13C + ATT	35.617*	1.834*	19.926*	1.00	1.00

*p < .001 **p < .05

Table 71. Russian Listening Standardized Regression Weights

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
13B	Intercept	APT	.779	.190	4.091	< .001
	Slope	APT	.199	.187	1.068	< .001
13C	Intercept	APT	.414	.207	2.001	.045**
	Slope	APT	.138	.205	.674	.500
	Intercept	COG	.868	.207	4.195	< .001
	Slope	COG	.161	.205	.788	.431
13D	Intercept	APT	.348	.212	1.639	.101
	Slope	APT	.242	.209	1.159	.247
	Intercept	COG	.877	.209	4.194	< .001
	Slope	COG	.142	.205	.692	.489
	Intercept	ATT	.307	.200	1.538	.124
	Slope	ATT	-.539	.196	-2.744	.006**

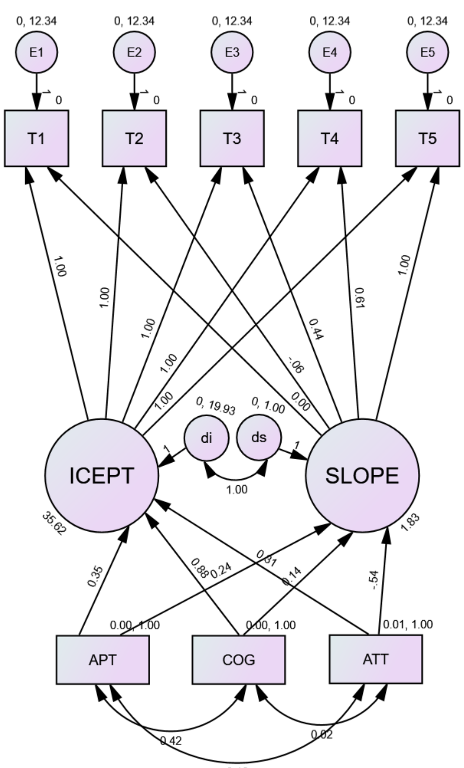
**p < .05

For the final model, Model 13D (Figure 38), the residual variances were all positive and significant (E1 = 12.338; *SE* = .366, CR = 33.703, $p < .001$; E2 = 12.338; *SE* = .366, CR = 33.703, $p < .001$; E3 = 12.338; *SE* = .366, CR = 33.703, $p < .001$; E4 = 12.338; *SE* = .366, CR = 33.703, $p < .001$; E5 = 12.338; *SE* = .366, CR = 33.703, $p < .001$). COG was a significant predictor of the intercept; general cognitive ability predicted the initial Russian Listening scores.

The covariance between APT and COG is also significant, so even though the prediction value of APT on the intercept decreases from one model to the next (see Table 71) this is likely due to COG being entered into the models. Interestingly, COG was a stronger predictor than APT. This goes against the prediction that APT would have more predictive value for DLI Language Difficulty Category III languages. ATT was a significant predictor of the slope; the regression weight was negative, suggesting that those who had more positive attitude towards learning at the beginning of their language training at DLI were less likely to experience language proficiency growth over the five test occasions. The other predictors may not have been significant predictors of the slope because although the mean slope was significant, there was a limited amount of growth in the Russian listening population.

Figure 38

Path Diagram Russian Listening: Phase II Model 13D



Phase III

The same dataset from Russian Listening Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time and then ATT was added. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 72.

Table 72. Russian Listening Descriptive Statistics: ASVAB and DLAB Subtests

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
ASVAB_WK*	700	62.01	.225	5.947	35.368	-.078	.092	-.287	.185
ASVAB_PC*	700	61.71	.172	4.561	20.803	-.410	.092	-.234	.185
ASVAB_AR*	700	61.92	.205	5.429	29.472	-.419	.092	.434	.185
ASVAB_MK*	700	62.27	.190	5.032	25.321	-.227	.092	-.371	.185
DLAB_PT1*	700	3.06	.061	1.619	2.621	.109	.092	-.530	.185
DLAB_PT2*	700	12.78	.114	3.004	9.026	-.224	.092	-.797	.185
DLAB_PT3*	700	46.02	.221	5.842	34.134	.233	.092	-.101	.185
DLAB_PT4*	700	19.12	.157	4.144	17.176	-.143	.092	-.689	.185

Descriptive statistics before standardization

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for DLI Language Difficulty Category III languages. The subtests were entered in the same order as they were for the Persian individual language analyses. When a subtest was not a significant predictor, it was excluded from the next model. The model fit statistics for all models are listed in Table 73, the parameter statistics are listed in Table 74, and the standardized regression weights are listed in Table 75. ASVAB subtests and DLAB subtests are abbreviated in the tables: ASVAB WK (WK), ASVAB PC (PC), ASVAB AR (AR), ASVAB MK (MK), DLAB PT 1 (PT1), DLAB PT2 (PT2), DLAB PT3 (PT3), DLAB PT4 (PT4).

Table 73. Russian Listening Model Fit Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
13A	Base	61.983	13	.000	.969	.002	.001 - .002

Model	*Model Variables*	χ^2	*df*	*P*	CFI	RMSEA	CI
13E	13A + PT3	62.878	16	.000	.971	.002	.001 - .002
13F	13E + PT2	65.200	19	.000	.972	.002	.001 - .002
13G	13E + PT1	76.605	19	.000	.965	.002	.001 - .002
13H	13E + PT4	64.838	19	.000	.973	.002	.001 - .002
13I	13H + WK	66.141	22	.000	.975	.001	.001 - .002
13J	13I + PC	68.404	22	.000	.974	.001	.001 - .002
13K	13J + AR	74.904	25	.000	.974	.001	.001 - .002
13L	13K – PT3 + MK	74.558	25	.000	.976	.001	.001 - .002
13M	13L – MK + ATT	83.088	25	.000	.969	.002	.001 - .002

Table 74. Russian Listening Parameter Statistics: ASVAB and DLAB Subtests

		Intercept (I)	Slope (S)			
Model	*Model Variables*	*M*	*M*	Variance (I)	Variance (S)	I/S Covariance
13A	Base	35.701*	1.827*	21.405*	1.00	1.00
13E	13A + PT3	35.705*	1.829*	20.887*	1.00	1.00
13F	13E + PT2	35.707*	1.851*	20.901*	1.00	1.00
13G	13E + PT1	35.663*	1.832*	20.699*	1.00	1.00
13H	13E + PT4	35.716*	1.843*	20.745*	1.00	1.00
13I	13H + WK	35.692*	1.832*	20.077*	1.00	1.00
13J	13I + PC	35.678*	1.824*	19.765*	1.00	1.00
13K	13J + AR	35.671*	1.836*	19.578*	1.00	1.00
13L	13K – PT3 + MK	35.662*	1.843*	19.626*	1.00	1.00
13M	13L – MK + ATT	35.599*	1.818*	19.492*	1.00	1.00

*p < .001 **p < .05

Table 75. Russian Listening Standardized Regression Weights: ASVAB and DLAB Subtests

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
13E	Intercept	PT3	.743	.191	3.896	< .001
	Slope	PT3	-.100	.186	-.537	.591
13F	Intercept	PT3	.749	.196	3.813	< .001
	Slope	PT3	-.175	.193	-.903	.366
	Intercept	PT2	-.025	.197	-.127	.899
	Slope	PT2	.277	.194	1.428	.153
13G	Intercept	PT3	.691	.194	3.557	< .001
	Slope	PT3	-.131	.190	-.693	.488
	Intercept	PT1	.284	.195	1.461	.144
	Slope	PT1	.250	.190	1.315	.188
13H	Intercept	PT3	.635	.201	3.160	.002**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	PT3	-.237	.196	-1.210	.226
	Intercept	PT4	.331	.202	1.641	.101
	Slope	PT4	.419	.198	2.122	.034**
13I	Intercept	PT3	.494	.202	2.439	.015**
	Slope	PT3	-.286	.200	-1.431	.152
	Intercept	PT4	.147	.205	.717	.473
	Slope	PT4	.348	.202	1.719	.086
	Intercept	WK	.780	.200	3.897	< .001
	Slope	WK	.347	.198	1.753	.080
13J	Intercept	PT3	.460	.195	2.358	.018**
	Slope	PT3	-.198	.194	-1.016	.310
	Intercept	WK	.574	.209	2.748	.006**
	Slope	WK	.411	.209	1.965	.049**
	Intercept	PC	.632	.205	3.076	.002**
	Slope	PC	.050	.204	.243	.808
13K	Intercept	PT3	.351	.200	1.755	.079
	Slope	PT3	-.174	.201	-.865	.387
	Intercept	WK	.514	.210	2.447	.014**
	Slope	WK	.428	.212	2.018	.044**
	Intercept	PC	.528	.209	2.519	.012**
	Slope	PC	.072	.210	.344	.731
	Intercept	AR	.490	.204	2.401	.016**
	Slope	AR	-.109	.205	-.530	.596
13L	Intercept	WK	.567	.208	2.730	.006**
	Slope	WK	.409	.210	1.950	.051
	Intercept	PC	.544	.210	2.596	.009**
	Slope	PC	.058	.211	.276	.783
	Intercept	AR	.462	.235	1.965	.049**
	Slope	AR	-.090	.236	-.382	.702
	Intercept	MK	.203	.227	.895	.371
	Slope	MK	-.112	.229	-.492	.623
13M	Intercept	WK	.564	.209	2.691	.007**
	Slope	WK	.417	.210	1.992	.046**
	Intercept	PC	.538	.211	2.546	.011**
	Slope	PC	.056	.210	.266	.790
	Intercept	AR	.575	.201	2.864	.004**
	Slope	AR	-.145	.200	-.723	.470
	Intercept	ATT	.380	.196	1.939	.053

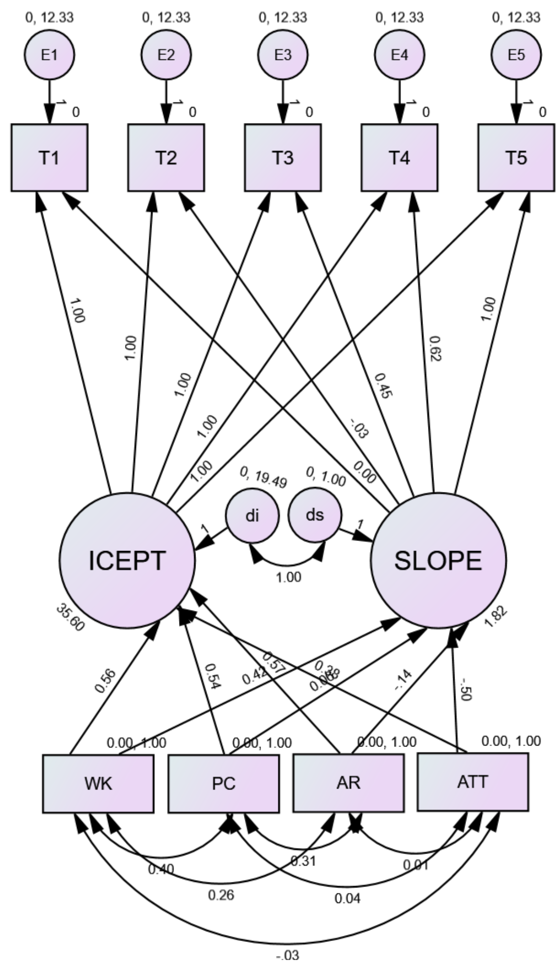
Model	Variable of Interest	Estimate	*SE*	*C.R.*	*p*
Slope	ATT	-.503	.195	-2.576	.010**

**p < .05

For the final model, 13M, (Figure 39), all residual variances were positive and significant (E1 = 12.330; SE = .366; CR = 33.717, p < .001; E2 = 12.330; SE = .366; CR = 33.717, p < .001; E3 = 12.330; SE = .366; CR = 33.717, p < .001; E4 = 12.330; SE = .366; CR = 33.717, p < .001; E5 = 12.330; SE = .366; CR = 33.717, p < .001). 13M was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (See Table 75). ASVAB AR had the largest regression weight value for the intercept (.575), followed by ASVAB WK (.564), and ASVAB PC (.538). These results suggest that those participants who had higher scores on these subtests were more likely to have higher DLPT listening scores at graduation. ATT had a significant predictive value for the slope, but it was negative (-.503), suggesting those participants who had a more negative attitude towards learning their assigned language ended up experiencing slightly more growth in language proficiency over the five test occasions. DLAB PT1, PT2, and PT4 were not found to be significant predictors of the intercept or slope. ASVAB MK was also not found to be a significant predictor of the intercept or slope, so it was excluded from the final model. DLAB PT3 was a significant predictor of the intercept until AR was entered into the model (Model 13K).

Figure 39

Path Diagram Russian Listening: Phase III Model 13M



Phase IV

The same dataset from Russian Listening Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 13M (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 76.

Table 76. Russian Listening Descriptive Statistics: Other predictors

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
GPA*	669	3.48	.012	.322	.104	-.527	.094	-.136	.189
AGE*	657	22.16	.132	3.388	11.479	1.151	.095	1.692	.190
EDUC*	658	4.10	.081	2.067	4.272	.463	.095	-1.345	.190
TRN_HRS*	418	360.29	12.809	261.874	68577.860	1.561	.119	2.887	.238
BILLET	544	.41	.021	.492	.242	.375	.105	-1.866	.209
SEX	700	.72	.017	.450	.203	-.974	.092	-1.054	.185

Descriptive statistics before standardization

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The predictors were entered in a specific order based on the limited amount of longitudinal research that exists that has examined the relationship between these predictors and language proficiency. The model fit statistics for all models are listed in Table 77, the parameter statistics are listed in Table 78, and the standardized regression weights are listed in Table 79.

Table 77. Russian Listening Model Fit Statistics: Other Predictors

Model	***Model Variables***	χ^2	*df*	*P*	**CFI**	**RMSEA**	**CI**
13M	13L – MK + ATT	83.088	25	.000	.969	.002	.001 - .002
13N	13M + GPA	84.790	28	.000	.973	.001	.001 - .002
13O	13N – AR + AGE	86.830	28	.000	.972	.001	.001 - .002
13P	13O – AGE + EDUC	86.583	28	.000	.972	.001	.001 - .002
13Q	13P + TRN_HRS	91.242	31	.000	.971	.001	.001 - .002
13R	13P + BILLET	89.995	31	.000	.972	.001	.001 - .002
13S	13P + SEX	87.353	31	.000	.973	.001	.001 - .002

Table 78. Russian Listening Parameter Statistics: Other Predictors

		Intercept (I)	**Slope (S)**			
Model	***Model Variables***	***M***	***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
13M	13L – MK + ATT	35.599*	1.818*	19.492*	1.00	1.00
13N	13M + GPA	35.611*	1.817*	13.118*	1.00	1.00
13O	13N – AR + AGE	35.585*	1.788*	12.906*	1.00	1.00
13P	13O – AGE + EDUC	35.590*	1.772*	12.774*	1.00	1.00
13Q	13P + TRN_HRS	35.573*	1.769*	12.591*	1.00	1.00
13R	13P + BILLET	35.112*	1.757*	12.430*	1.00	1.00
13S	13P + SEX	35.164*	1.791*	12.718*	1.00	1.00

*p < .001 **p < .05

Table 79. Russian Listening Standardized Regression Weights: Other Predictors

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
13N	Intercept	WK	.239	.183	1.307	.191
	Slope	WK	.446	.211	2.109	.035**
	Intercept	PC	.521	.183	2.847	.004**
	Slope	PC	.058	.211	.277	.782
	Intercept	AR	.147	.176	.834	.404
	Slope	AR	-.140	.203	-.692	.489
	Intercept	ATT	.183	.170	1.074	.283
	Slope	ATT	-.516	.196	-2.635	.008**
	Intercept	GPA	2.609	.170	15.386	< .001
	Slope	GPA	.025	.197	.129	.897
13O	Intercept	WK	.364	.192	1.895	.058
	Slope	WK	.335	.218	1.534	.125
	Intercept	PC	.573	.179	3.196	.001**
	Slope	PC	-.007	.204	-.034	.973
	Intercept	ATT	.185	.171	1.078	.281
	Slope	ATT	-.521	.195	-2.673	.008**
	Intercept	GPA	2.601	.169	15.365	< .001
	Slope	GPA	.023	.194	.118	.906
	Intercept	AGE	-.330	.182	-1.817	.069
	Slope	AGE	.298	.206	1.446	.148
13P	Intercept	WK	.399	.187	2.132	.033**
	Slope	WK	.339	.213	1.596	.110
	Intercept	PC	.588	.178	3.293	< .001
	Slope	PC	-.009	.202	-.045	.964
	Intercept	ATT	.159	.171	.930	.352
	Slope	ATT	-.505	.194	-2.606	.009**
	Intercept	GPA	2.634	.168	15.718	< .001
	Slope	GPA	.006	.191	.032	.975
	Intercept	EDUC	-.544	.177	-3.066	.002**
	Slope	EDUC	.337	.200	1.683	.092
13Q	Intercept	WK	.394	.188	2.099	.036**
	Slope	WK	.346	.217	1.597	.110
	Intercept	PC	.591	.179	3.304	< .001
	Slope	PC	-.017	.206	-.082	.935
	Intercept	ATT	.159	.172	.927	.354

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	ATT	-.554	.198	-2.798	.005**
	Intercept	GPA	2.640	.168	15.706	< .001
	Slope	GPA	.028	.195	.143	.886
	Intercept	EDUC	-.565	.178	-3.172	.002**
	Slope	EDUC	.332	.204	1.626	.104
	Intercept	TRN_HRS	.289	.211	1.369	.171
	Slope	TRN_HRS	.438	.233	1.880	.060
13R	Intercept	WK	.382	.186	2.052	.040**
	Slope	WK	.341	.212	1.608	.108
	Intercept	PC	.596	.177	3.365	< .001
	Slope	PC	-.010	.202	-.049	.961
	Intercept	ATT	.137	.170	.808	.419
	Slope	ATT	-.501	.194	-2.587	.010**
	Intercept	GPA	2.666	.167	16.008	< .001
	Slope	GPA	.002	.191	.011	.991
	Intercept	EDUC	-.518	.176	-2.939	.003**
	Slope	EDUC	.335	.200	1.674	.094
	Intercept	BILLET	1.170	.372	3.147	.002**
	Slope	BILLET	.027	.415	.064	.949
13S	Intercept	WK	.377	.188	2.008	.045**
	Slope	WK	.342	.213	1.603	.109
	Intercept	PC	.562	.179	3.143	.002**
	Slope	PC	-.010	.203	-.051	.959
	Intercept	ATT	.155	.171	.908	.364
	Slope	ATT	-.505	.194	-2.607	.009**
	Intercept	GPA	2.647	.168	15.793	< .001
	Slope	GPA	.004	.192	.023	.982
	Intercept	EDUC	-.517	.178	-2.907	.004**
	Slope	EDUC	.338	.201	1.682	.093
	Intercept	SEX	.596	.367	1.624	.104
	Slope	SEX	-.028	.416	-.068	.946

**$p < .05$

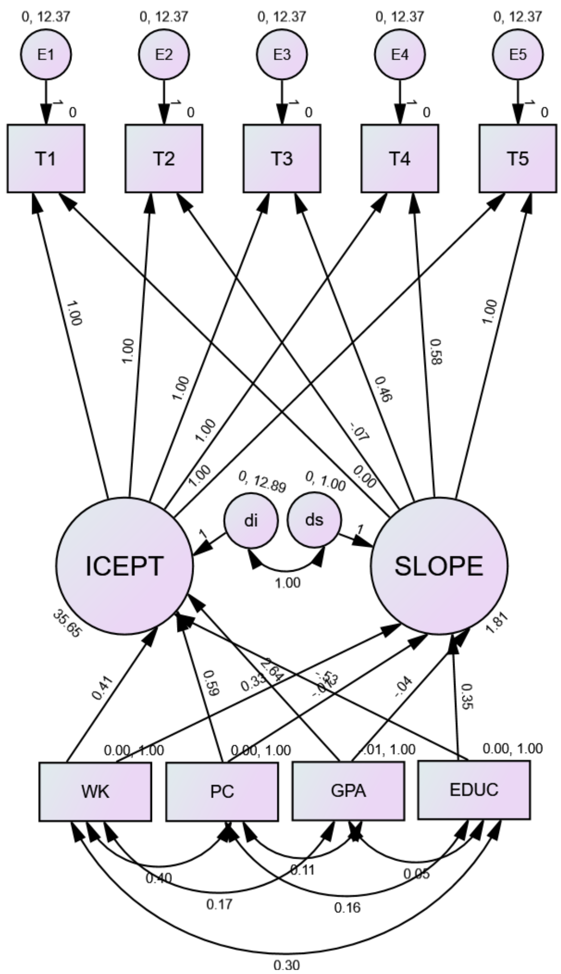
For the final model, 13P, (Figure 40), all residual variances were positive and significant (E1 = 12.366; SE = .367; CR = 33.721, $p < .001$; E2 = 12.366; SE = .367; CR = 33.721, $p < .001$; E3 = 12.366; SE = .367; CR = 33.721, $p < .001$; SE = 12.366; SE = .367; CR = 33.721, $p < .001$;

E4 = 12.366; SE = .367; CR = 33.721, $p < .001$; E5 = 12.366; SE = .367; CR = 33.721, $p < .001$). 13P was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 79). GPA had the largest significant regression weight on the intercept (2.634), followed by ASVAB PC (.588), ASVAB WK (.399), and EDUC (-.531). These results suggest that those participants who had higher GPAs at DLI, who had higher scores on the WK and PC ASVAB subtests, and who started out with lower level of education (most likely high school or one year of college) when they started studying at DLI were more likely to have higher DLPT listening scores at graduation. The only predictor that had a significant predictive value for the slope was ATT (-.505), and it was negative, implying that those participants with more of a negative attitude towards learning their assigned language ended up experiencing slightly more growth in listening language proficiency (as measured by the DLPT) over the five test occasions. AGE, TRN_HRS, and SEX were not found to be significant predictors of the intercept or slope in the analysis. BILLET was found to be a significant predictor of the intercept; however, this result is not meaningful as participants are not assigned their billet types until after they attend DLI. BILLET was not found to be a significant predictor of the slope. There was a significant covariance between several of the predictors (see Appendix). The predictive value of the predictors that covary with GPA (WK, PC, AR) were likely reduced because GPA was the strongest predictor of the intercept.

The results from Phases II, III, and IV for the Russian DLPT listening suggest that the participants' GPA had the largest positive impact on their performance on the DLPT listening at graduation. The participants whose performance on the ASVAB WK and ASVAB PC was higher were more likely to perform better on the DLPT listening at graduation. The results also suggest that those participants who started at DLI with less education experienced more growth in language proficiency over the five DLPT listening test occasions.

Figure 40

Path Diagram Russian Listening: Phase IV Model 13P



Russian Reading

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Russian DLPT reading was 700 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Russian reading sample are shown in Table 80. 77.1% of the sample had four test occasions, and 55.8% had five test occasions. Figure 42 displays the mean DLPT listening scores at each test occasion. The average listening proficiency decreased very slightly between Time1 and Time2 but then increased from one test occasion to the next. The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Russian reading scores at all test occasions are slightly negatively skewed and that the scores are slightly leptokurtic except for Time2's scores which are slightly platykurtic.

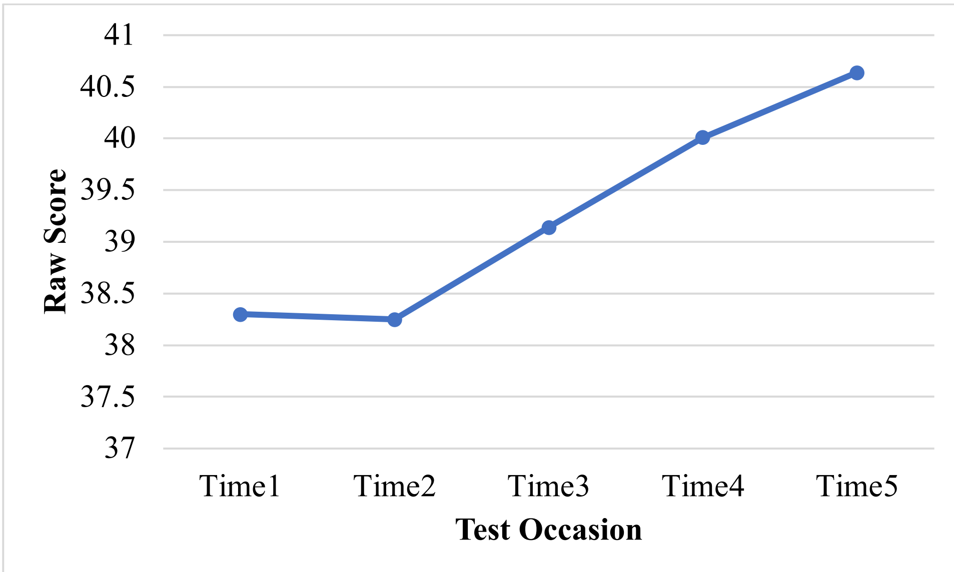
Table 80. Russian Reading Descriptive Statistics

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
Time1	700	38.30	.211	5.591	31.259	-.979	.092	2.268	.185
Time2	700	38.25	.205	5.425	29.426	-.348	.092	-.067	.185
Time3	700	39.14	.202	5.350	28.628	-.396	.092	.101	.185
Time4	540	40.01	.223	5.184	26.878	-.572	.105	.621	.210
Time5	391	40.64	.237	4.687	21.969	-.500	.123	.580	.246
APT*	700	115.50	.467	12.353	152.591	.587	.092	.115	.185
COG*	700	90.14	.319	8.451	71.416	-1.376	.092	1.867	.185
ATT*	661	4.36	.034	.871	.759	-1.165	.095	.692	.190

Descriptive statistics before standardization

Figure 41

Mean DLPT Reading Scores by Test Occasion: Russian



Two growth models, linear and non-linear were compared. The linear model, Model 14AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 14A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 14A indicated a slightly better model fit (χ^2= 128.404*, df* = 13*, p* = .00; CFI = .916; RMSEA = .003, CI = .002-.003) than Model 14AA (χ^2= 132.766*, df* = 16 *, p* = .00; CFI = .914; RMSEA = .003, CI = .003-.004). Therefore, Model 14A was accepted as the base model.

For Model 14A, the mean slope was positive and significant (*M* = 2.613, *p* < .001) indicating that the Russian DLPT reading scores increased over time. The mean intercept was significant (*M* = 38.220, *p* < .001). The covariance between the slope and the intercept was set to a constant, 1.0. The slope variance set to a constant, 1.0, so that the model would converge. The intercept variance (16.560, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial Russian DLPT Reading score. Table 82 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Language Difficulty Category III languages. The model fit statistics for all models are listed in Table 81, the parameter statistics are listed in Table 82, and the standardized regression weights are listed in Table 83.

Table 81. Russian Reading Model Fit Statistics

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
14A	Base	128.404	13	.000	.916	.003	.002 - .003
14B	14A + APT	130.805	16	.000	.920	.003	.002 - .003
14C	14B + COG	131.904	19	.000	.930	.002	.002 - .003
14D	14C + ATT	136.159	22	.000	.930	.002	.002 - .002

Table 82. Russian Reading Parameter Statistics

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope (S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
14A	Base	38.220*	2.613*	16.560*	1.00	1.0
14B	14A + APT	38.219*	2.627*	15.007*	1.00	1.0
14C	14B + COG	38.217*	2.627*	13.951*	1.00	1.0
14D	14C + ATT	38.211*	2.629*	13.952*	1.00	1.0

*p < .001 **p < .05

Table 83. Russian Reading Standardized Regression Weights

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
14B	Intercept	APT	1.265	.170	7.436	< .001
	Slope	APT	-.083	.188	-.441	.659

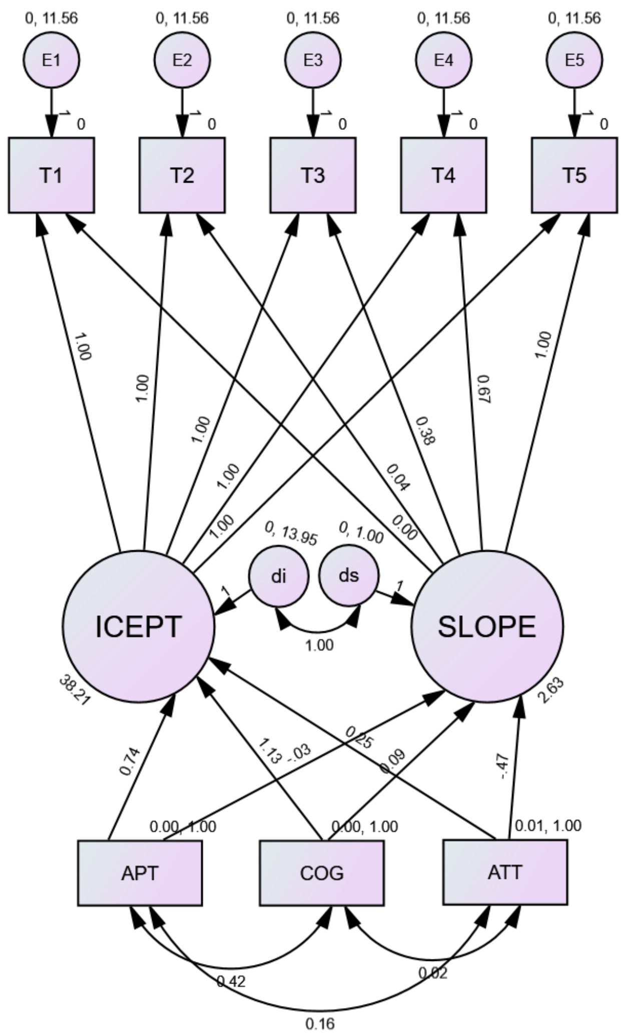
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
14C	Intercept	APT	.793	.183	4.336	< .001
	Slope	APT	-.122	.208	-.586	.558
	Intercept	COG	1.117	.183	6.112	< .001
	Slope	COG	.115	.208	.555	.579
14D	Intercept	APT	.744	.186	4.008	< .001
	Slope	APT	-.030	.211	-.142	.887
	Intercept	COG	1.131	.183	6.177	< .001
	Slope	COG	.093	.208	.449	.654
	Intercept	ATT	.250	.174	1.440	.150
	Slope	ATT	-.471	.196	-2.409	.016**

**p < .05

For the final model, Model 14D (Figure 42), the residual variances were all positive and significant (E1 = 11.557; *SE* = .342, CR = 33.762, $p < .001$; E2 = 11.557; *SE* = .342, CR = 33.762, $p < .001$; E3 = 11.557; *SE* = .342, CR = 33.762, $p < .001$; E4 = 11.557; *SE* = .342, CR = 33.762, $p < .001$; E5 = 11.557; *SE* = .342, CR = 33.762, $p < .001$). APT and COG were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial Russian Reading scores. The covariance between APT and COG is also significant, so even though the prediction value of APT on the intercept decreases from one model to the next (see Table 83) this is likely due to COG being entered into the models. Interestingly, COG was a stronger predictor than APT. This goes against the prediction that APT would have more predictive value for DLI Language Difficulty Category III languages. ATT was a significant predictor of the slope; the regression weight was negative (-.471), implying that those participants who started at DLI with a more positive attitude towards learning their assigned language ended up experiencing less growth over the five DLPT reading test occasions.

Figure 42

Path Diagram Russian Reading: Phase II Model 14D



Phase III

The same dataset from Russian Reading Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 84.

Table 84. Russian Reading Descriptive Statistics: ASVAB and DLAB Subtests

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
ASVAB_WK*	700	62.04	.224	5.937	35.245	-.081	.092	-.282	.185
ASVAB_PC*	700	61.71	.172	4.563	20.817	-.412	.092	-.234	.185
ASVAB_AR*	700	61.94	.205	5.416	29.333	-.426	.092	.464	.185
ASVAB_MK*	700	62.27	.190	5.034	25.340	-.230	.092	-.373	.185
DLAB_PT1*	700	3.07	.061	1.621	2.626	.106	.092	-.538	.185
DLAB_PT2*	700	12.78	.114	3.007	9.042	-.223	.092	-.802	.185
DLAB_PT3*	700	46.01	.221	5.843	34.140	.235	.092	-.100	.185
DLAB_PT4*	700	19.13	.157	4.160	17.307	-.149	.092	-.693	.185

***Descriptive statistics before standardization**

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for ILR Category III languages. The subtests were entered in the same order as they were for the Russian listening analysis. When a subtest was not a significant predictor, it was excluded from the next model. The model fit statistics for all models are listed in Table 85, the parameter statistics are listed in Table 86, and the standardized regression weights are listed in Table 87. ASVAB subtests and DLAB subtests are abbreviated in the tables: ASVAB WK (WK), ASVAB PC (PC), ASVAB AR (AR), ASVAB MK (MK), DLAB PT 1 (PT1), DLAB PT2 (PT2), DLAB PT3 (PT3), DLAB PT4 (PT4).

Table 85. Russian Reading Model Fit Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
14A	Base	128.404	13	.000	.916	.003	.002 - .003
14E	14A + PT3	128.658	16	.000	.920	.003	.002 - .003
14F	14E + PT2	131.500	19	.000	.922	.002	.002 - .003
14G	14E + PT1	144.697	19	.000	.913	.003	.002 - .003
14H	14G + PT4	145.386	22	.000	.920	.003	.002 - .003
14I	14H + WK	146.691	22	.000	.928	.002	.002 - .003
14J	14I + PC	147.855	28	.000	.934	.002	.002 - .002
14K	14J + AR	157.300	31	.000	.936	.003	.002 - .002
14L	14K – PT3 + MK	157.881	31	.000	.940	.002	.002 - .002
14M	14L – MK + ATT	160.944	31	.000	.930	.002	.002 - .002

Table 86. Russian Reading Parameter Statistics: ASVAB and DLAB Subtests

		Intercept (I)	Slope (S)			
Model	***Model Variables***	***M***	***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
14A	Base	38.220*	2.613*	16.560*	1.00	1.00
14E	14A + PT3	38.218*	2.619*	15.721*	1.00	1.00
14F	14E + PT2	38.225*	2.617*	15.669*	1.00	1.00
14G	14E + PT1	38.169*	2.627*	15.363*	1.00	1.00
14H	14G + PT4	38.167*	2.617*	14.802*	1.00	1.00
14I	14H + WK	38.167*	2.609*	13.623*	1.00	1.00
14J	14I + PC	38.162*	2.606*	13.458*	1.00	1.00
14K	14J + AR	38.159*	2.611*	13.317*	1.00	1.00
14L	14K – PT3 + MK	38.161*	2.613*	13.294*	1.00	1.00
14M	14L – MK + ATT	38.154*	2.609*	13.344*	1.00	1.00

*p < .001 **p < .05

Table 87. Russian Reading Standardized Regression Weights: ASVAB and DLAB Subtests

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
14E	Intercept	PT3	.941	.173	5.434	< .001
	Slope	PT3	-.110	.188	-.584	.559
14F	Intercept	PT3	.888	.178	4.984	< .001
	Slope	PT3	-.152	.194	-.783	.434
	Intercept	PT2	.219	.178	1.231	.219
	Slope	PT2	.154	.194	.796	.426
14G	Intercept	PT3	.865	.176	4.918	< .001
	Slope	PT3	-.184	.192	-.955	.340
	Intercept	PT1	.420	.176	2.382	.017**
	Slope	PT1	.469	.193	2.426	.015**
14H	Intercept	PT3	.594	.182	3.259	.001**
	Slope	PT3	-.085	.201	-.420	.675
	Intercept	PT1	.360	.175	2.058	.040**
	Slope	PT1	.487	.194	2.518	.012
	Intercept	PT4	.879	.181	4.860	< .001
	Slope	PT4	-.316	.200	-1.576	.115
14I	Intercept	PT3	.405	.179	2.260	.024**
	Slope	PT3	-.089	.204	-.437	.662
	Intercept	PT1	.208	.171	1.214	.225
	Slope	PT1	.490	.195	2.506	.012**
	Intercept	PT4	.623	.180	3.461	< .001
	Slope	PT4	-.321	.205	-1.564	.118

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Intercept	WK	1.153	.178	6.492	< .001
	Slope	WK	.052	.202	.258	.797
14J	Intercept	PT3	.370	.179	2.067	.039**
	Slope	PT3	-.081	.205	-.395	.693
	Intercept	PT1	.190	.171	1.111	.267
	Slope	PT1	.496	.195	2.540	.011**
	Intercept	PT4	.556	.181	3.069	.002**
	Slope	PT4	-.304	.207	-1.467	.142
	Intercept	WK	.993	.187	5.305	< .001
	Slope	WK	.094	.214	.440	.660
	Intercept	PC	.480	.183	2.615	.009**
	Slope	PC	-.126	.210	-.600	.549
14K	Intercept	PT3	.294	.181	1.622	.105
	Slope	PT3	-.079	.208	-.381	.703
	Intercept	PT1	.170	.170	.999	.318
	Slope	PT1	.500	.196	2.551	.011**
	Intercept	PT4	.482	.183	2.627	.009**
	Slope	PT4	-.303	.211	-1.438	.150
	Intercept	WK	.958	.187	5.117	< .001
	Slope	WK	.097	.215	.451	.652
	Intercept	PC	.400	.186	2.148	.032**
	Slope	PC	-.122	.214	-.573	.567
	Intercept	AR	.429	.183	2.342	.019**
	Slope	AR	-.012	.210	-.059	.953
14L	Intercept	PT1	.192	.169	1.133	.257
	Slope	PT1	.489	.195	2.512	.012**
	Intercept	PT4	.509	.180	2.822	.005**
	Slope	PT4	-.329	.208	-1.583	.113
	Intercept	WK	.998	.186	5.368	< .001
	Slope	WK	.086	.214	.402	.688
	Intercept	PC	.400	.186	2.155	.031**
	Slope	PC	-.122	.214	-.572	.567
	Intercept	MK	.306	.208	1.469	.142
	Slope	MK	-.068	.240	-.284	.776
14M	Intercept	PT1	.179	.170	1.056	.291
	Slope	PT1	.525	.195	2.697	.007**
	Intercept	PT4	.503	.181	2.787	.005**
	Slope	PT4	-.262	.207	-1.267	.205

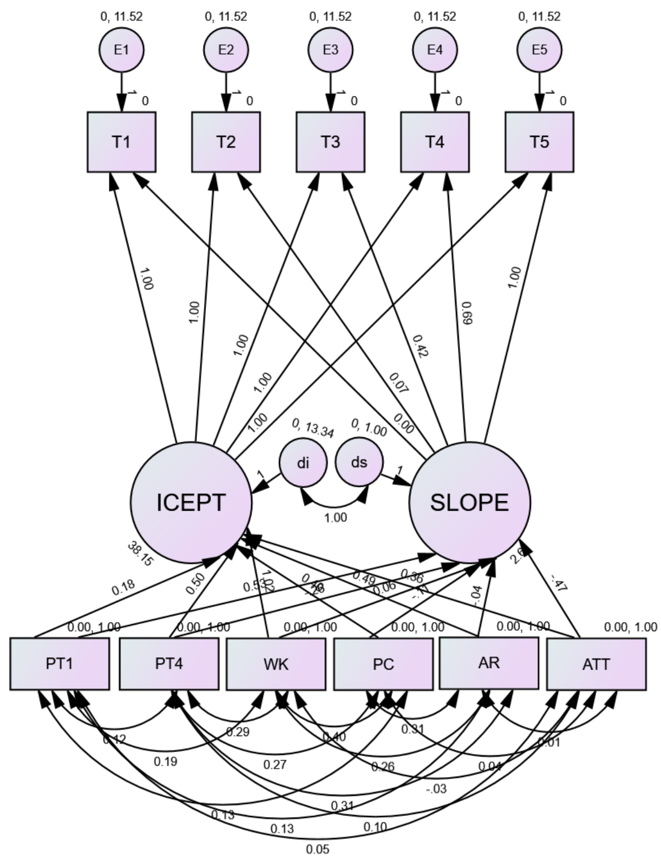
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Intercept	WK	1.017	.187	5.446	< .001
	Slope	WK	.063	.214	.293	.769
	Intercept	PC	.397	.186	2.132	.033**
	Slope	PC	-.109	.213	-.510	.610
	Intercept	AR	.492	.180	2.727	.006**
	Slope	AR	-.045	.206	-.216	.829
	Intercept	ATT	.355	.171	2.072	.038**
	Slope	ATT	-.470	.195	-2.411	.016**

**p < .05

For the final model, 14M, (Figure 43), all residual variances were positive and significant (E1 = 11.522; SE = .341; CR = 33.768, p < .001; E2 = 11.522; SE = .341; CR = 33.768, p < .001; E3 = 11.522; SE = .341; CR = 33.768, p < .001; E4 = 11.522; SE = .341; CR = 33.768, p < .001; E5 = 11.522; SE = .341; CR = 33.768, p < .001). 14M was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 87). ASVAB WK had the largest regression weight value for the intercept (1.017), followed by DLAB PT4 (.503), ASVAB AR (.492), ASVAB PC (.397), and ATT (.355). These results suggest that those participants who had higher scores on these subtests and who had a more positive (higher) attitude towards learning the language they were assigned to were more likely to have higher DLPT reading scores at graduation. The only subtest that had a significant predictive value for the slope was DLAB PT1 (.525), implying that those participants who had higher scores on the DLAB PT1 experienced slightly more growth in reading language proficiency (as measured by the DLPT) over the five test occasions. ATT also had a significant predictive value for the slope, but it was negative (-.470), implying that those participants who had a more positive attitude towards learning their assigned language when starting at DLI experienced slightly less growth in language proficiency over the five test occasions.

Figure 43

Path Diagram Russian Reading: Phase III Model 14M



Phase IV

The same dataset from Russian Listening Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 14M (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 88.

Table 88. Russian Reading Descriptive Statistics: Other predictors

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
GPA*	669	3.48	.012	.322	.104	-.529	.094	-.129	.189
AGE*	658	22.16	.132	3.380	11.422	1.155	.095	1.725	.190
EDUC*	659	4.09	.080	2.066	4.268	.465	.095	-1.343	.190
TRN_HRS*	418	360.29	12.809	261.874	68577.860	1.561	.119	2.887	.238
BILLET	544	.41	.021	.492	.242	.375	.105	-1.866	.209
SEX	700	.72	.017	.449	.201	-.990	.092	-1.023	.185

***Descriptive statistics before standardization**

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The predictors were entered in a specific order based on the limited amount of longitudinal research that exists that has examined the relationship between these predictors and language proficiency. The model fit statistics for all models are listed in Table 89, the parameter statistics are listed in Table 90, and the standardized regression weights are listed in Table 91.

Table 89. Russian Reading Model Fit Statistics: Other Predictors

Model	*Model Variables*	χ^2	*df*	*p*	CFI	RMSEA	CI
14M	14L – MK + ATT	160.944	31	.000	.930	.002	.002 - .002
14N	14M +GPA	168.367	34	.000	.937	.002	.002 - .002
14O	14N – AR + AGE	161.635	34	.000	.940	.002	.002 - .002
14P	14O – AGE + EDUC	161.641	34	.000	.941	.002	.002 - .002
14Q	14P – EDUC + TRN_HRS	161.157	34	.000	.936	.002	.002 - .002
14R	14P – EDUC + BILLET	162.853	34	.000	.935	.002	.002 - .002
14S	14P – EDUC + SEX	161.102	34	.000	.936	.002	.002 - .002

Table 90. Russian Reading Parameter Statistics: Other Predictors

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
14M	14L – MK + ATT	38.154*	2.609*	13.344*	1.00	1.00
14N	14M + GPA	38.184*	2.600*	8.964*	1.00	1.00
14O	14N – AR + AGE	38.183*	2.589*	8.946*	1.00	1.00
14P	14O – AGE + EDUC	38.171*	2.573*	8.966*	1.00	1.00
14Q	14P – EDUC + TRN_HRS	38.196*	2.588*	8.843*	1.00	1.00
14R	14P – EDUC + BILLET	37.824*	2.732*	8.846*	1.00	1.00
14S	14P – EDUC + SEX	38.407*	1.944*	9.018*	1.00	1.00

*p < .001 **p < .05

Table 91. Russian Reading Standardized Regression Weights: Other Predictors

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
14N	Intercept	PT1	-.235	.153	-1.539	.124
	Slope	PT1	.524	.199	2.637	.008**
	Intercept	PT4	.466	.160	2.922	.003**
	Slope	PT4	-.274	.207	-1.324	.186
	Intercept	WK	.804	.166	4.854	< .001
	Slope	WK	.080	.215	.370	.712
	Intercept	PC	.390	.164	2.372	.018**
	Slope	PC	-.096	.214	-.450	.653
	Intercept	AR	.187	.161	1.162	.245
	Slope	AR	-.048	.209	-.230	.818
	Intercept	ATT	.224	.152	1.475	.140
	Slope	ATT	-.486	.196	-2.483	.013**
	Intercept	GPA	2.158	.154	14.002	< .001
	Slope	GPA	.079	.202	.394	.694
14O	Intercept	PT1	-.257	.158	-1.623	.105
	Slope	PT1	.490	.205	2.385	.017**
	Intercept	PT4	.497	.156	3.180	.001**
	Slope	PT4	-.290	.203	-1.431	.152
	Intercept	WK	.792	.172	4.599	< .001
	Slope	WK	.027	.223	.121	.903
	Intercept	PC	.420	.161	2.603	.009**
	Slope	PC	-.113	.209	-.541	.588
	Intercept	ATT	.235	.152	1.545	.122
	Slope	ATT	-.470	.196	-2.396	.017**
	Intercept	GPA	2.206	.155	14.264	< .001
	Slope	GPA	.066	.202	.329	.742
	Intercept	AGE	.109	.167	.650	.516
	Slope	AGE	.156	.215	.723	.470
14P	Intercept	PT1	-.141	.169	-.834	.404
	Slope	PT1	.382	.218	1.750	.080
	Intercept	PT4	.526	.157	3.349	< .001
	Slope	PT4	-.307	.203	-1.515	.130
	Intercept	WK	.869	.169	5.127	< .001
	Slope	WK	-.011	.218	-.048	.962
	Intercept	PC	.431	.162	2.659	.008**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	PC	-.115	.209	-.553	.580
	Intercept	ATT	.203	.153	1.325	.185
	Slope	ATT	-.445	.197	-2.264	.024**
	Intercept	GPA	2.163	.154	14.038	< .001
	Slope	GPA	.090	.200	.452	.652
	Intercept	EDUC	-.237	.175	-1.351	.177
	Slope	EDUC	.392	.224	1.745	.081
14Q	Intercept	PT1	-.227	.153	-1.486	.137
	Slope	PT1	.518	.198	2.612	.009**
	Intercept	PT4	.546	.157	3.484	< .001
	Slope	PT4	-.284	.204	-1.398	.162
	Intercept	WK	.806	.165	4.891	< .001
	Slope	WK	.073	.214	.342	.732
	Intercept	PC	.419	.161	2.598	.009**
	Slope	PC	-.105	.209	-.502	.615
	Intercept	ATT	.205	.152	1.351	.177
	Slope	ATT	-.490	.196	-2.503	.012**
	Intercept	GPA	2.189	.152	14.353	< .001
	Slope	GPA	.071	.200	.355	.723
	Intercept	TRN_HRS	.385	.187	2.059	.039**
	Slope	TRN_HRS	.012	.233	.051	.959
14R	Intercept	PT1	-.230	.152	-1.513	.130
	Slope	PT1	.514	.198	2.597	.009**
	Intercept	PT4	.539	.155	3.470	< .001
	Slope	PT4	-.294	.202	-1.453	.146
	Intercept	WK	.809	.164	4.931	< .001
	Slope	WK	.074	.213	.344	.731
	Intercept	PC	.428	.160	2.666	.008**
	Slope	PC	-.103	.209	-.495	.621
	Intercept	ATT	.197	.151	1.306	.192
	Slope	ATT	-.477	.195	-2.443	.015**
	Intercept	GPA	2.202	.152	14.491	< .001
	Slope	GPA	.066	.199	.330	.742
	Intercept	BILLET	.923	.333	2.771	.006**
	Slope	BILLET	-.342	.424	-.806	.420
14S	Intercept	PT1	-.238	.154	-1.550	.121
	Slope	PT1	.556	.200	2.782	.005**
	Intercept	PT4	.512	.156	3.287	.001**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	PT4	-.302	.202	-1.493	.136
	Intercept	WK	.828	.165	5.022	< .001
	Slope	WK	.057	.214	.267	.789
	Intercept	PC	.437	.162	2.701	.007**
	Slope	PC	-.151	.210	-.720	.472
	Intercept	ATT	.226	.151	1.491	.136
	Slope	ATT	-.496	.195	-2.541	.011**
	Intercept	GPA	2.178	.153	14.280	< .001
	Slope	GPA	.077	.199	.388	.698
	Intercept	SEX	-.290	.330	-.878	.380
	Slope	SEX	.915	.429	2.135	.033**

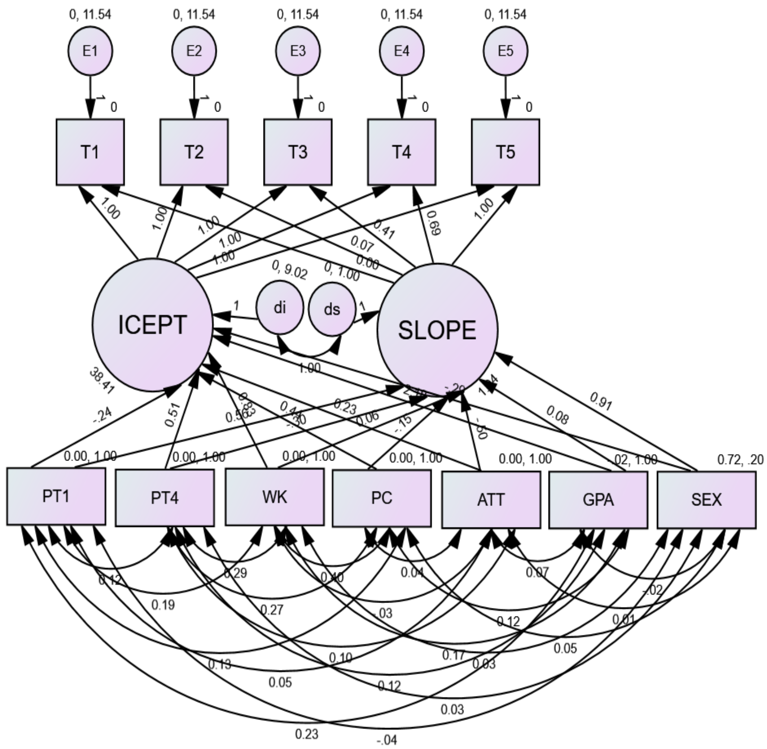
**p < .05

For the final model, 14S, (Figure 44), all residual variances were positive and significant (E1 = 11.535; SE = .341; CR = 33.789, p < .001; E2 = 11.535; SE = .341; CR = 33.789, p < .001; E3 = 11.535; SE = .341; CR = 33.789, p < .001; E4 = 11.535; SE = .341; CR = 33.789, p < .001; E5 = 11.535; SE = .341; CR = 33.789, p < .001). 14S was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 91). GPA had the largest significant regression weight on the intercept (2.178), followed by ASVAB WK (.828), DLAB PT4 (.512), and ASVAB PC (.437). These results suggest that those participants who had higher GPAs at DLI, those had higher scores on the WK and PC ASVAB subtests, and those who had higher scores on the DLAB PT4 were more likely to have higher DLPT listening scores at graduation. SEX had the highest significant regression weight on the slope (.915) followed by DLAB PT1 (.556) and ATT (-.496), although the weight for ATT was negative. These results imply that those participants who are male, had higher scores on the DLAB PT1 and who had a lower or more negative attitude towards learning their assigned language were likely to experience slightly more growth in reading language proficiency (as measured by the DLPT) over the five test occasions. EDUC and AGE were not found to be significant predictors of the intercept or slope in the analysis (see Table 91). TRN_HRS and BILLET was found to be a significant predictor of the intercept; however, these results are not meaningful as participants are not assigned their billet types and do not attend internal DOD training until after they attend DLI. There was a significant covariance between several of the predictors (see Appendix).

The results from Phases II, III, and IV for the Russian DLPT reading suggest that the participants' GPA had the largest positive impact on their performance on the DLPT reading at graduation with those participants with higher GPAs performing better. The participants whose performance was better on the ASVAB WK, DLAB PT4, ASVAB PC were more likely to perform better on the DLPT reading at graduation. The results also suggest that those participants who are male, performed better on the DLAB PT1, and started their language training at DLI with a relatively negative attitude towards learning their assigned language experienced more growth in language proficiency over the five DLPT reading test occasions.

Figure 44

Path Diagram Russian Reading: Phase IV Model 14S



Chinese Listening

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Chinese DLPT listening was 948 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Chinese listening sample are shown in Table 92. 82.4% of the sample had four test occasions, and 57.4% had five test occasions. Figure 45 displays the mean DLPT listening scores at each test occasion. The average listening proficiency decreased between Time1 and Time2 but then increased from one test occasion to the next. The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Chinese listening scores at all test occasions are slightly negatively skewed and that the scores are slightly platykurtic or slightly leptokurtic.

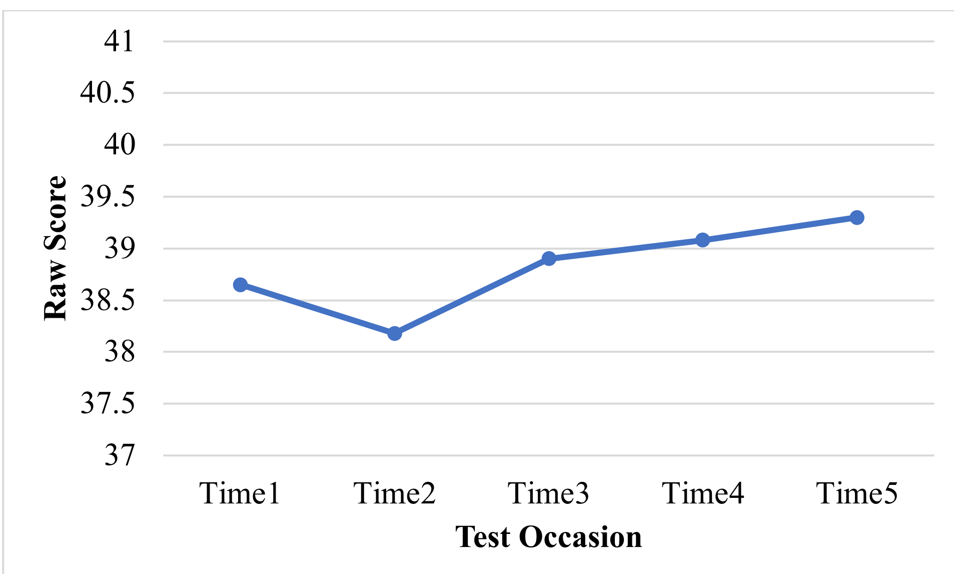
Table 92. Chinese Listening Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	948	38.65	.159	4.901	24.018	-.348	.079	.454	.159
Time2	948	38.18	.162	4.979	24.791	-.269	.079	-.105	.159
Time3	948	38.90	.171	5.270	27.773	-.344	.079	.127	.159
Time4	781	39.08	.187	5.213	27.176	-.342	.087	.571	.175
Time5	544	39.30	.211	4.917	24.182	-.350	.105	.261	.209
APT*	948	123.09	.355	10.918	119.205	.042	.079	-.181	.159
COG*	948	92.87	.224	6.894	47.530	-1.615	.079	2.584	.159
ATT*	918	4.36	.028	.841	.707	-1.264	.081	1.424	.161

***Descriptive statistics before standardization**

Figure 45

Mean DLPT Listening Scores by Test Occasion: Chinese



Two growth models, linear and non-linear were compared. The linear model, Model 15AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 15A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 15A indicated a better model fit (χ^2= 115.851*, df* = 11*, p* = .00; CFI = .939; RMSEA = .003, CI = .003-.004) than Model 15AA (χ^2= 123.207*, df* = 14 *, p* = .00; CFI = .937; RMSEA = .003, CI = .003-.004). Therefore, Model 15A was accepted as the base model.

For Model 15A, the mean slope was positive and significant (*M* = 1.103, *p* < .001) indicating that the Chinese DLPT listening scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 38.448, *p* < .001). The significant positive covariance between the slope and the intercept (2.544, *p* < .001) indicates that higher initial scores on the Chinese DLPT Listening were associated with higher rates of change and that lower initial scores on the Chinese DLPT Listening were associated with lower rates of change over time. The slope variance (.614, *p* > .05) was not significant. The intercept variance (12.924, *p* < .001) was significant indicating that there were significant inter-participant differences on the initial Chinese DLPT Listening score. Table 94 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Difficulty Category IV languages (See Chapter 4). The model fit statistics for all models are listed in Table 93, the parameter statistics are listed in Table 94, and the standardized regression weights are listed in Table 95.

Table 93. Chinese Listening Model Fit Statistics

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
15A	Base	115.851	11	.000	.939	.003	.003 - .004
15B	15A + APT	118.513	14	.000	.941	.003	.002 - .003

Model	*Model Variables*	χ^2	*df*	*P*	CFI	RMSEA	CI
15C	15B + COG	120.246	17	.000	.946	.002	.002 - .003
15D	15C + ATT	120.366	20	.000	.948	.002	.002 - .003

Table 94. Chinese Listening Parameter Statistics

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
15A	Base	38.448*	1.103*	12.924*	.614	2.544*
15B	15A + APT	38.460*	1.105*	12.156*	.522	2.432*
15C	15B + COG	26.103*	-1.402	12.089*	.548	2.419*
15D	15C + ATT	38.548*	1.116*	12.117*	.455	2.407*

*p < .001 **p < .05

Table 95. Chinese Listening Standardized Regression Weights

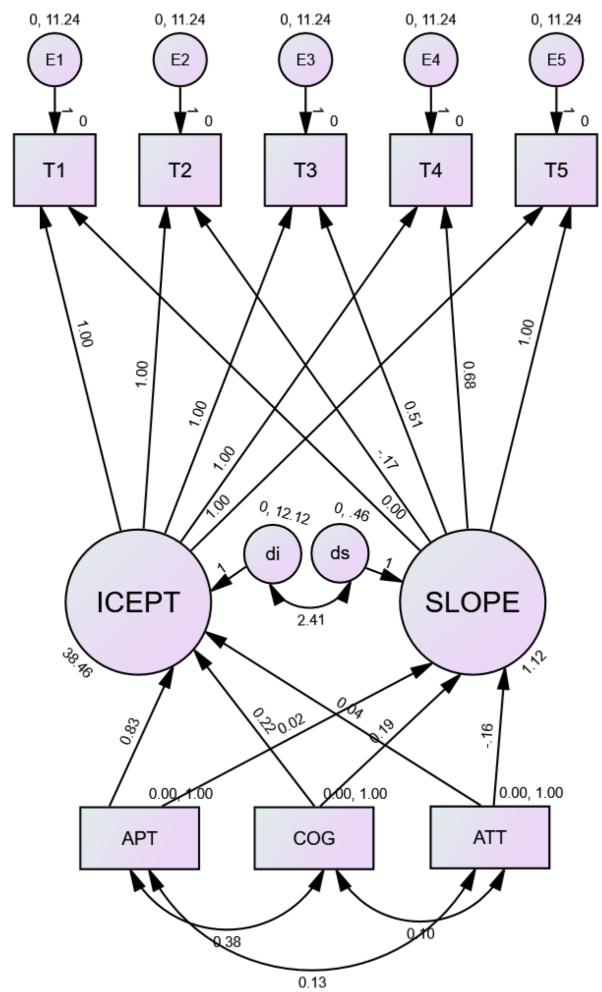
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
15B	Intercept	APT	.920	.132	6.983	< .001
	Slope	APT	.073	.132	.556	.578
15C	Intercept	APT	.076	.013	5.856	< .001
	Slope	APT	.000	.013	.034	.973
	Intercept	COG	.032	.021	1.524	.127
	Slope	COG	.027	.021	1.258	.208
15D	Intercept	APT	.832	.143	5.805	< .001
	Slope	APT	.022	.144	.150	.881
	Intercept	COG	.217	.143	1.518	.129
	Slope	COG	.185	.144	1.283	.199
	Intercept	ATT	.038	.135	.279	.780
	Slope	ATT	-.161	.136	-1.190	.234

**p < .05

For the final model, Model 15D (Figure 46), the residual variances were all positive and significant (E1 = 11.242; *SE* = .325, CR = 34.639, $p < .001$; E2 = 11.242; *SE* = .325, CR = 34.639, $p < .001$; E3 = 11.242; *SE* = .325, CR = 34.639, $p < .001$; E4 = 11.242; *SE* = .325, CR = 34.639, $p < .001$; E5 = 11.242; *SE* = .325, CR = 34.639, $p < .001$). APT was a significant predictor of the intercept; language aptitude predicted the initial Chinese Listening scores. The covariance between APT and COG is also significant. COG and ATT were not significant predictors of the intercept and none of the predictors were significant predictors of the slope. This may be because although the mean slope was significant, there was a limited amount of growth in the Chinese listening population.

Figure 46

Path Diagram Chinese Listening: Phase II Model 15D



Phase III

The same dataset from Chinese Listening Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time.

ATT was not added to the model as it was not significant in Phase II. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 96.

Table 96. Chinese Listening Descriptive Statistics: ASVAB and DLAB Subtests

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
ASVAB_WK*	948	63.34	.194	5.975	35.695	-.175	.079	-.098	.159
ASVAB_PC*	948	62.90	.144	4.421	19.547	-.605	.079	-.144	.159
ASVAB_AR*	948	63.64	.163	5.016	25.163	-.392	.079	-.015	.159
ASVAB_MK*	948	63.82	.159	4.898	23.986	-.329	.079	-.134	.159
DLAB_PT1*	948	3.45	.051	1.565	2.449	.110	.079	-.562	.159
DLAB_PT2*	948	13.72	.092	2.834	8.031	-.543	.079	-.314	.159
DLAB_PT3*	948	48.81	.172	5.304	28.134	-.179	.079	-.228	.159
DLAB_PT4*	948	20.97	.123	3.799	14.435	-.361	.079	-.235	.159

Descriptive statistics before standardization

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for DLI Difficulty Category IV languages. The subtests were entered in the following order, one at a time: DLAB_PT3 (grammar), DLAB_PT2 (stress patterns), DLAB_PT1 (biographical questions), DLAB_PT4 (picture-word association), ASVAB WK (word knowledge), ASVAB PC (paragraph comprehension), ASVAB AR (arithmetic reasoning), ASVAB MK (math knowledge). When a subtest was not a significant predictor, it was excluded from the next model. The model fit statistics for all models are listed in Table 97, the parameter statistics are listed in Table 98, and the standardized regression weights are listed in Table 99. ASVAB subtests and DLAB subtests are abbreviated in the tables: ASVAB WK (WK), ASVAB PC (PC), ASVAB AR (AR), ASVAB MK (MK), DLAB PT 1 (PT1), DLAB PT2 (PT2), DLAB PT3 (PT3), DLAB PT4 (PT4).

Table 97. Chinese Listening Model Fit Statistics: ASVAB and DLAB Subtests

Model	*Model Variables*	χ^2	*df*	*p*	CFI	RMSEA	CI
15A	Base	115.851	11	.000	.939	.003	.003 - .004
15E	15A + PT3	119.304	14	.000	.940	.003	.002 - .003

Model	*Model Variables*	χ^2	*df*	*p*	CFI	RMSEA	CI
15F	15E + PT2	122.065	17	.000	.943	.002	.002 - .003
15G	15F + PT1	123.357	20	.000	.944	.002	.002 - .003
15H	15G + PT4	131.906	23	.000	.943	.002	.002 - .003
15I	15H + WK	133.309	26	.000	.947	.002	.002 - .002
15J	15G + PC	132.266	26	.000	.946	.002	.002 - .002
15K	15J + AR	133.720	29	.000	.952	.002	.002 - .002
15L	15J + MK	133.317	29	.000	.951	.002	.002 - .002

Table 98. Chinese Listening Parameter Statistics: ASVAB and DLAB Subtests

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
15A	Base	38.448*	1.103*	12.924*	.614	2.544*
15E	15A + PT3	38.452*	1.114*	12.526*	.597	2.514*
15F	15E + PT2	38.451*	1.115*	12.365*	.609	2.506*
15G	15F + PT1	38.390*	1.147*	11.993*	1.112	2.528*
15H	15G + PT4	38.412*	1.128*	11.860*	.772	2.530*
15I	15H + WK	38.408*	1.132*	11.834*	.807	2.525*
15J	15G + PC	38.418*	1.125*	11.796*	.705	2.547*
15K	15J + AR	38.421*	1.126*	11.812*	.655	2.544*
15L	15J + MK	38.435*	1.100*	11.867*	.451	2.483*

*p < .001 **p < .05

Table 99. Chinese Listening Standardized Regression Weights: ASVAB and DLAB Subtests

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
15E	Intercept	PT3	.660	.133	4.948	< .001
	Slope	PT3	.028	.133	.209	.835
15F	Intercept	PT3	.546	.138	3.953	< .001
	Slope	PT3	.024	.139	.170	.865
	Intercept	PT2	.410	.138	2.965	.003**
	Slope	PT2	.022	.139	.161	.872
15G	Intercept	PT3	.532	.140	3.799	< .001
	Slope	PT3	-.001	.150	-.008	.994
	Intercept	PT2	.408	.140	2.918	.004**
	Slope	PT2	.025	.150	.165	.869
	Intercept	PT1	.117	.138	.851	.395
	Slope	PT1	.506	.151	3.362	< .001
15H	Intercept	PT3	.407	.142	2.861	.004**
	Slope	PT3	.013	.148	.087	.930

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Intercept	PT2	.424	.138	3.071	.002**
	Slope	PT2	.019	.144	.128	.898
	Intercept	PT1	.129	.136	.949	.342
	Slope	PT1	.478	.146	3.284	.001**
	Intercept	PT4	.521	.136	3.821	< .001
	Slope	PT4	-.058	.143	-.408	.683
15I	Intercept	PT3	.398	.144	2.766	.006**
	Slope	PT3	-.009	.151	-.062	.951
	Intercept	PT2	.420	.138	3.033	.002**
	Slope	PT2	.015	.145	.105	.916
	Intercept	PT1	.116	.137	.846	.397
	Slope	PT1	.460	.148	3.118	.002**
	Intercept	PT4	.508	.139	3.644	< .001
	Slope	PT4	-.082	.147	-.558	.577
	Intercept	WK	.063	.141	.443	.658
	Slope	WK	.149	.149	1.001	.317
15J	Intercept	PT3	.364	.143	2.548	.011**
	Slope	PT3	.022	.149	.146	.884
	Intercept	PT2	.412	.138	2.995	.003**
	Slope	PT2	.021	.143	.148	.883
	Intercept	PT1	.095	.136	.697	.486
	Slope	PT1	.481	.146	3.298	< .001
	Intercept	PT4	.470	.138	3.412	< .001
	Slope	PT4	-.049	.143	-.342	.732
	Intercept	PC	.320	.138	2.324	.020**
	Slope	PC	-.069	.143	-.484	.628
15K	Intercept	PT3	.353	.144	2.452	.014**
	Slope	PT3	.010	.150	.065	.948
	Intercept	PT2	.411	.137	2.990	.003**
	Slope	PT2	.019	.143	.134	.894
	Intercept	PT1	.093	.136	.685	.493
	Slope	PT1	.476	.146	3.266	.001**
	Intercept	PT4	.448	.143	3.128	.002**
	Slope	PT4	-.070	.149	-.473	.636
	Intercept	PC	.299	.142	2.101	.036**
	Slope	PC	-.090	.148	-.608	.543
	Intercept	AR	.085	.149	.574	.566
	Slope	AR	.078	.155	.503	.615

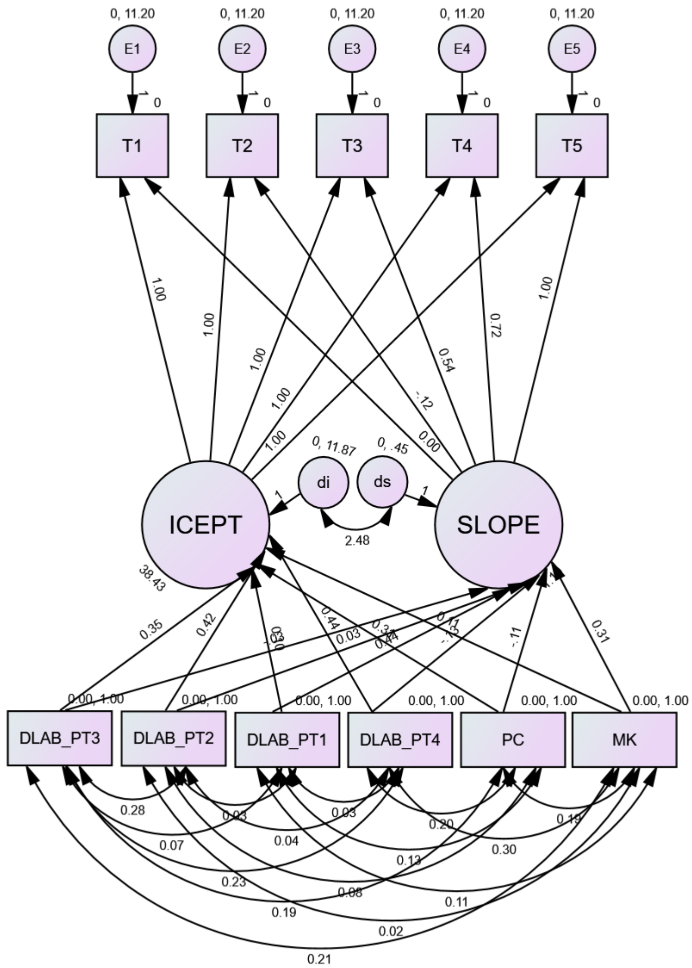
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
15L	Intercept	PT3	.348	.144	2.420	.016**
	Slope	PT3	-.028	.145	-.190	.849
	Intercept	PT2	.416	.137	3.034	.002**
	Slope	PT2	.035	.139	.251	.802
	Intercept	PT1	.096	.136	.709	.478
	Slope	PT1	.441	.141	3.120	.002**
	Intercept	PT4	.444	.142	3.133	.002**
	Slope	PT4	-.134	.144	-.932	.351
	Intercept	PC	.307	.138	2.227	.026**
	Slope	PC	-.107	.140	-.763	.446
	Intercept	MK	.114	.142	.803	.422
	Slope	MK	.313	.146	2.146	.032**

**p < .05

For the final model, 15L, (Figure 47), all residual variances were positive and significant (E1 = 11.202; SE = .324; CR = 34.608, p < .001; E2 = 11.202; SE = .324; CR = 34.608, p < .001; E3 = 11.202; SE = .324; CR = 34.608, p < .001; E4 = 11.202; SE = .324; CR = 34.608, p < .001; E5 = 11.202; SE = .324; CR = 34.608, p < .001). 15L was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 99). DLAB PT4 had the largest regression weight value for the intercept (.444), followed by DLAB PT2(.416), DLAB PT3 (.348), and ASVAB PC (.307). These results suggest that those participants who had higher scores on these subtests were more likely to have higher DLPT listening scores at graduation. The only subtests that had a significant predictive value for the slope were DLAB PT1 (.441) and ASVAB MK (.313), implying that those participants who had higher scores on the DLAB PT2 and ASVAB MK experienced slightly more growth in listening language proficiency (as measured by the DLPT) over the five test occasions. ASVAB WK and AR were not found to be a significant predictors of the intercept or slope.

Figure 47

Path Diagram Chinese Listening: Phase III Model 15L



Phase IV

The same dataset from Chinese Listening Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 15L (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 100.

Table 100. Chinese Listening Descriptive Statistics: Other predictors

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
GPA*	912	3.52	.010	.305	.093	-.388	.081	-.355	.162
AGE*	915	22.65	.109	3.303	10.910	.637	.081	.362	.162
EDUC*	913	4.42	.068	2.041	4.166	.192	.081	-1.425	.162
TRN_HRS*	621	522.97	12.437	309.917	96048.601	.940	.098	1.227	.196
BILLET	745	.52	.018	.500	.250	-.094	.090	-1.996	.179
SEX	948	.73	.014	.444	.197	-1.038	.079	-.925	.15 9

Descriptive statistics before standardization

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The model fit statistics for all models are listed in Table 101, the parameter statistics are listed in Table 102, and the standardized regression weights are listed in Table 103.

Table 101. Chinese Listening Model Fit Statistics: Other Predictors

Model	*Model Variables*	χ^2	*df*	*P*	CFI	RMSEA	CI
15L	15J + MK	133.317	29	.000	.951	.002	.002 - .002
15M	15L + GPA	134.139	32	.000	.961	.002	.001 - .002
15N	15M – MK + AGE	132.596	26	.000	.956	.002	.002 - .002
15O	15N + EDUC	138.980	29	.000	.964	.002	.002 - .002
15P	15N + TRN_HRS	138.081	29	.000	.955	.002	.002 - .002
15Q	15N + BILLET	136.570	29	.000	.956	.002	.002 - .002
15R	15N + SEX	133.123	29	.000	.958	.002	.002 - .002

Table 102. Chinese Listening Parameter Statistics: Other Predictors

		Intercept (I)	**Slope (S)**			
Model	***Model Variables***	***M***	***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
15L	15J + MK	38.435*	1.100*	11.867*	.451	2.483*
15M	15L + GPA	38.458*	1.079*	6.573*	.326	1.601**
15N	15M – MK + AGE	38.402*	.749*	7.330*	6.698*	-1.439*
15O	15N + EDUC	38.397*	.764*	7.252*	6.614*	-1.347
15P	15N + TRN_HRS	38.419*	.696*	7.491*	6.924*	-1.695
15Q	15N + BILLET	38.140*	1.376*	6.170*	2.073	1.346
15R	15N + SEX	38.155*	.640	7.285*	6.640*	-1.398

*p < .001 **p < .05

Table 103. Chinese Listening Standardized Regression Weights: Other Predictors

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
15M	Intercept	PT3	-.036	.121	-.295	.768
	Slope	PT3	-.068	.146	-.463	.643
	Intercept	PT2	.157	.115	1.369	.171
	Slope	PT2	-.014	.138	-.103	.918
	Intercept	PT1	-.267	.115	-2.328	.020**
	Slope	PT1	.396	.141	2.812	.005**
	Intercept	PT4	.313	.118	2.657	.008**
	Slope	PT4	-.146	.143	-1.019	.308
	Intercept	PC	.263	.115	2.291	.022**
	Slope	PC	-.115	.139	-.827	.408
	Intercept	MK	-.015	.119	-.130	.896
	Slope	MK	.274	.144	1.896	.058
	Intercept	GPA	2.408	.118	20.473	< .001
	Slope	GPA	.383	.145	2.640	.008**
15N	Intercept	PT1	-.275	.139	-1.979	.048**
	Slope	PT1	.425	.182	2.333	.020**
	Intercept	PT4	.287	.135	2.125	.034**
	Slope	PT4	.026	.176	.145	.885
	Intercept	PC	.421	.140	3.003	.003**
	Slope	PC	-.162	.182	-.888	.374
	Intercept	GPA	2.169	.138	15.772	< .001
	Slope	GPA	.621	.182	3.413	< .001
	Intercept	AGE	-.699	.145	-4.830	< .001
	Slope	AGE	.571	.190	3.009	.003**
15O	Intercept	PT1	-.227	.146	-1.557	.120
	Slope	PT1	.431	.192	2.247	.025**
	Intercept	PT4	.303	.135	2.236	.025**
	Slope	PT4	.025	.177	.141	.888
	Intercept	PC	.425	.140	3.042	.002**
	Slope	PC	-.163	.183	-.895	.371
	Intercept	GPA	2.182	.137	15.880	< .001
	Slope	GPA	.622	.183	3.403	< .001
	Intercept	AGE	-.585	.180	-3.246	.001**
	Slope	AGE	.580	.236	2.453	.014**
	Intercept	EDUC	-.197	.187	-1.053	.293
	Slope	EDUC	-.016	.244	-.066	.947
15P	Intercept	PT1	-.285	.141	-2.014	.044**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	PT1	.443	.183	2.417	.016**
	Intercept	PT4	.279	.137	2.041	.041**
	Slope	PT4	.043	.176	.243	.808
	Intercept	PC	.419	.142	2.964	.003**
	Slope	PC	-.155	.182	-.849	.396
	Intercept	GPA	2.163	.139	15.569	< .001
	Slope	GPA	.623	.182	3.425	< .001
	Intercept	AGE	-.707	.146	-4.829	< .001
	Slope	AGE	.565	.190	2.979	.003**
	Intercept	TRN_HRS	-.089	.165	-.539	.590
	Slope	TRN_HRS	.257	.209	1.230	.219
15Q	Intercept	PT1	-.211	.123	-1.713	.087
	Slope	PT1	.429	.168	2.555	.011**
	Intercept	PT4	.329	.119	2.772	.006**
	Slope	PT4	-.052	.161	-.322	.747
	Intercept	PC	.399	.123	3.239	.001**
	Slope	PC	-.170	.167	-1.019	.308
	Intercept	GPA	2.280	.122	18.646	< .001
	Slope	GPA	.551	.168	3.283	.001**
	Intercept	AGE	-.551	.128	-4.314	< .001
	Slope	AGE	.396	.173	2.293	.022**
	Intercept	BILLET	.416	.261	1.595	.111
	Slope	BILLET	-.483	.349	-1.384	.167
15R	Intercept	PT1	-.256	.140	-1.830	.067
	Slope	PT1	.435	.184	2.372	.018**
	Intercept	PT4	.274	.136	2.023	.043**
	Slope	PT4	.017	.177	.095	.924
	Intercept	PC	.398	.141	2.814	.005**
	Slope	PC	-.174	.185	-.942	.346
	Intercept	GPA	2.179	.137	15.849	< .001
	Slope	GPA	.627	.182	3.438	< .001
	Intercept	AGE	-.710	.145	-4.888	< .001
	Slope	AGE	.560	.190	2.939	.003**
	Intercept	SEX	.333	.306	1.089	.276
	Slope	SEX	.161	.399	.404	.686

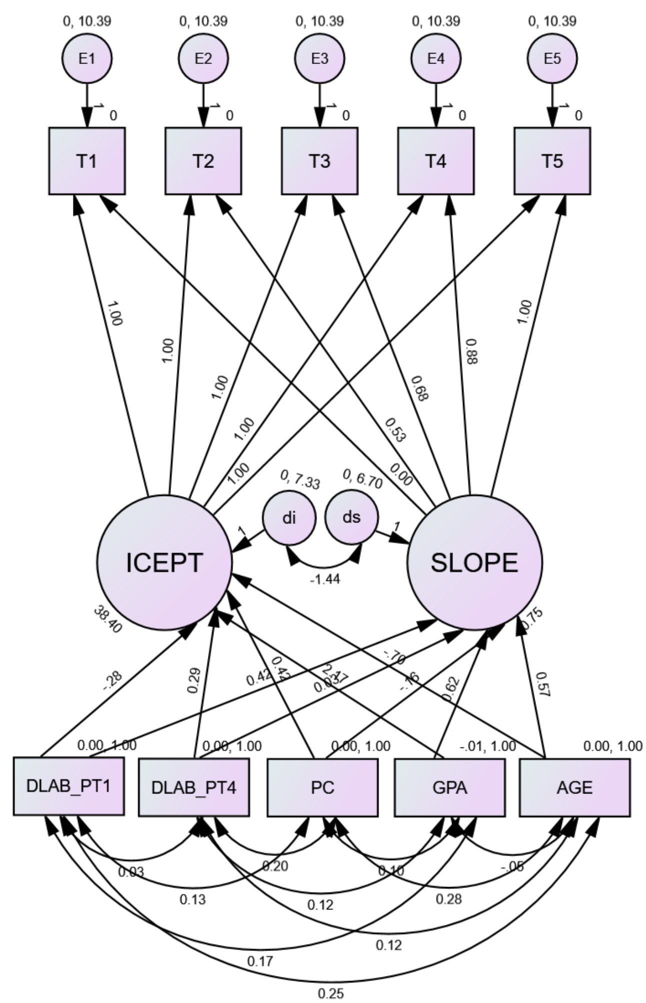
**p < .05

For the final model, 15N, (Figure 48), all residual variances were positive and significant (E1 = 10.387; SE = .305; CR = 34.062, p < .001; E2 = 10.387; SE = .305; CR = 34.062, p < .001; E3 = 10.387; SE = .305; CR = 34.062, p < .001; E4 = 10.387; SE = .305; CR = 34.062, p < .001; E5 = 10.387; SE = .305; CR = 34.062, p < .001). 15N was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 103). GPA had the largest significant regression weight on the intercept (2.169), followed by AGE (-.699), although the weight was negative, ASVAB PC (.421), DLAB PT4 (.287), and DLAB PT1 (-.275). These results suggest that those participants who had higher GPAs at DLI, were younger when beginning their studies at DLI, had higher scores on the ASVAB PC and DLAB PT4 subtests, and had lower scores on the DLAB PT1 subtest were more likely to have higher DLPT listening scores at graduation. GPA had the largest significant predictive value for the slope (.621), followed by AGE (.571) and DLAB PT1 (.425), implying that those participants who had higher GPAs while at DLI, who were older when they attended DLI, and who performed better on the DLAB PT1 were more likely to experience growth in listening language proficiency (as measured by the DLPT) over the five test occasions. EDUC, TRN_HRS, BILLET, and SEX were not found to be significant predictors of the intercept or slope in the analysis (see Table 103). There was a significant covariance between several of the predictors (see Appendix). The predictive value of the predictors that covary with GPA (PT3, PT2, 1, PT4, PC, MK, EDUC) were likely reduced because GPA was the strongest predictor of the intercept.

The results from Phases II, III, and IV for the Chinese DLPT listening suggest that the participants' GPA had the largest positive impact on their performance on the DLPT listening at graduation. The participants whose performance on the ASVAB PC and DLAB PT4 was better were more likely to perform better on the DLPT listening at graduation. In addition, participants whose scores were lower on the DLAB PT1 and those who were younger when beginning their studies at DLI were more likely to have higher scores on the DLPT listening at graduation. However, the results also suggest that those participants who had higher GPAs, higher scores on the DLAB PT1, and who were older while attending DLI were most likely to experience growth in listening language proficiency over the five test occasions.

Figure 48

Path Diagram Chinese Listening: Phase IV Model 15N



Chinese Reading

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Chinese DLPT reading was 949 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Chinese reading sample are shown in Table 104. 82.7% of the sample had four test occasions, and 56.9% had five test occasions. Figure 50 displays the mean DLPT reading scores at each test occasion. The average listening proficiency decreased between Time1 and Time2 but then increased from one test occasion to the next. The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Chinese reading scores at all test occasions are slightly negatively skewed and that the scores are slightly leptokurtic or platykurtic.

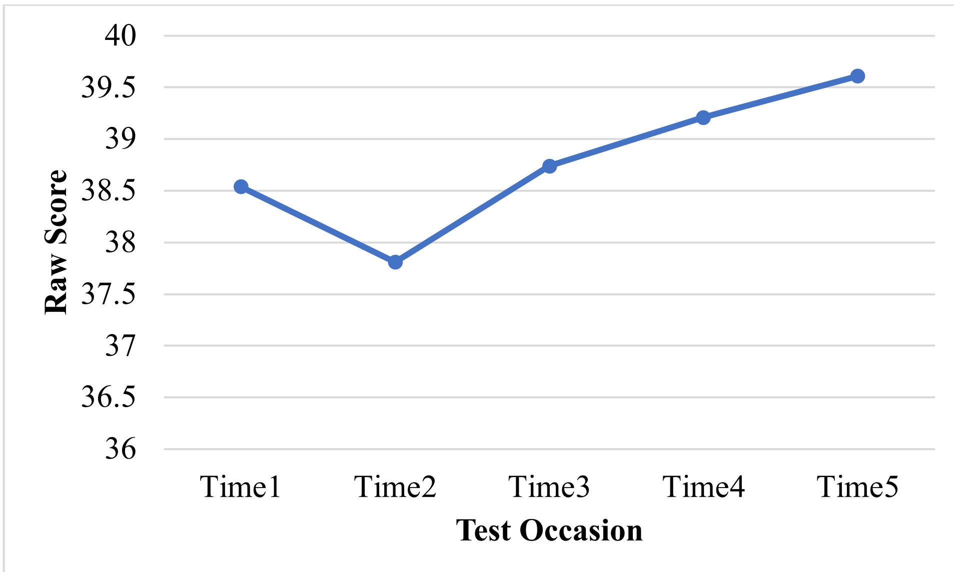
Table 104. Chinese Reading Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	949	38.54	.155	4.784	22.883	-.617	.079	1.596	.159
Time2	949	37.81	.171	5.260	27.671	-.349	.079	-.069	.159
Time3	949	38.74	.181	5.565	30.973	-.641	.079	.528	.159
Time4	785	39.21	.184	5.168	26.708	-.405	.087	-.183	.174
Time5	540	39.61	.223	5.180	26.827	-.490	.105	.290	.210
APT*	949	123.07	.355	10.928	119.413	.039	.079	-.186	.159
COG*	949	92.85	.224	6.914	47.806	-1.611	.079	2.548	.159
ATT*	918	4.36	.028	.842	.709	-1.258	.081	1.399	.161

Descriptive statistics before standardization

Figure 49

Mean DLPT Reading Scores by Test Occasion: Chinese



Two growth models, linear and non-linear were compared. The linear model, Model 16AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 16A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 16A indicated a better model fit (χ^2= 185.925, *df* = 11, *p* = .00; CFI = .886; RMSEA = .004, CI = .003-.003=4) than Model 16AA (χ^2= 206.414, *df* = 14 , *p* = .00; CFI = .874; RMSEA = .004, CI = .003-.004). Therefore, Model 16A was accepted as the base model.

For Model 16A, the mean slope was positive and significant (*M* = 1.888, *p* < .001) indicating that the Chinese DLPT reading scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 38.216, *p* < .001). The covariance between the slope and the intercept was significant (3.958, $p < .001$) implying that those participants who had higher DLPT scores at graduation experienced more growth over the five test occasions. The slope variance was not significant (.483, $p > .05$), indicating that there were not significant inter-participant differences in terms of growth on Chinese DLPT Reading over the five test occasions. The intercept variance (12.110, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial Chinese DLPT Reading score. Table 106 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Language Difficulty Category IV languages. The model fit statistics for all models are listed in Table 105, the parameter statistics are listed in Table 106, and the standardized regression weights are listed in Table 107.

Table 105. Chinese Reading Model Fit Statistics

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
16A	Base	185.925	11	.000	.886	.004	.003 - .004
16B	16A + APT	186.741	14	.000	.893	.003	.003 - .004
16C	16B + COG	187.860	17	.000	.904	.003	.003 - .004
16D	16C + ATT	192.008	20	.000	.904	.003	.003 - .003

Table 106. Chinese Reading Parameter Statistics

Model	***Model Variables***	**Intercept (I) *M***	**Slope (S) *M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
16A	Base	38.216*	1.888*	12.110*	.483	3.958*
16B	16A + APT	38.224*	1.882*	10.796*	.421	3.750*
16C	16B + COG	38.206*	1.908*	10.496*	.439	3.982*
16D	16C + ATT	38.195*	1.889*	10.409*	.431	4.017*

*p < .001   **p < .05

Table 107. Chinese Reading Standardized Regression Weights

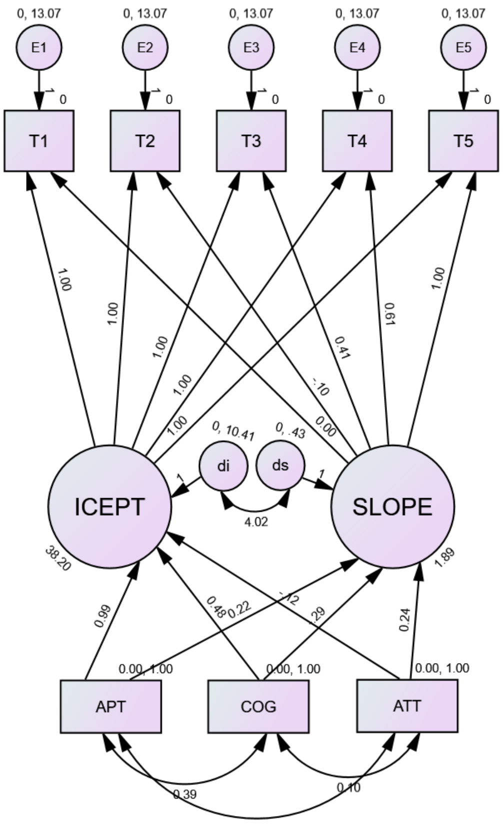
Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
16B	Intercept	APT	1.164	.128	9.062	< .001
	Slope	APT	.126	.154	.819	.413
16C	Intercept	APT	.977	.139	7.040	< .001
	Slope	APT	.245	.170	1.438	.150
	Intercept	COG	.475	.139	3.420	< .001
	Slope	COG	-.282	.171	-1.652	.098
16D	Intercept	APT	.987	.139	7.076	< .001
	Slope	APT	.220	.171	1.291	.197
	Intercept	COG	.484	.139	3.475	< .001
	Slope	COG	-.288	.170	-1.692	.091
	Intercept	ATT	-.117	.132	-.886	.375
	Slope	ATT	.241	.160	1.511	.131

**p < .05

For the final model, Model 16D (Figure 50), the residual variances were all positive and significant (E1 = 13.066; *SE* = .373, CR = 35.024, *p* < .001; E2 = 13.066; *SE* = .373, CR = 35.024, *p* < .001; E3 = 13.066; *SE* = .373, CR = 35.024, *p* < .001; E4 = 13.066; *SE* = .373, CR = 35.024, *p* < .001; E5 = 13.066; *SE* = .373, CR = 35.024, *p* < .001). APT and COG were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial Chinese Reading scores. APT was a stronger predictor (.987) than COG (.484). None of the predictors were significant predictors of the slope. This may be because although the mean slope was significant, there was a limited amount of growth in the Chinese reading population.

Figure 50

Path Diagram Chinese Reading: Phase II Model 16D



Phase III

The same dataset from Chinese Reading Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 108.

Table 108. Chinese Reading Descriptive Statistics: ASVAB and DLAB Subtests

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
ASVAB_WK*	949	63.64	.163	5.019	25.187	-.392	.079	-.024	.159
ASVAB_PC*	949	63.35	.194	5.978	35.738	-.177	.079	-.102	.159
ASVAB_AR*	949	62.89	.143	4.415	19.495	-.604	.079	-.140	.159

	N	M	SE	SD	VARIANCE	SKEW	SE	KURTOSIS	SE
ASVAB_MK*	949	63.80	.159	4.893	23.944	-.326	.079	-.135	.159
DLAB_PT1*	949	3.45	.051	1.569	2.461	.109	.079	-.569	.159
DLAB_PT2*	949	13.72	.092	2.848	8.108	-.549	.079	-.309	.159
DLAB_PT3*	949	48.82	.173	5.317	28.267	-.171	.079	-.233	.159
DLAB_PT4*	949	20.97	.123	3.787	14.343	-.363	.079	-.223	.159

Descriptive statistics before standardization

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for DLI Language Difficulty Category IV languages. The subtests were entered in the same order as they were for the Chinese listening analysis. When a subtest was not a significant predictor, it was excluded from the next model. The model fit statistics for all models are listed in Table 109, the parameter statistics are listed in Table 110, and the standardized regression weights are listed in Table 111.

Table 109. Chinese Reading Model Fit Statistics: ASVAB and DLAB Subtests

Model	*Model Variables*	χ^2	*df*	*p*	CFI	RMSEA	CI
16A	Base	185.925	11	.000	.886	.004	.003 - .004
16E	16A + PT3	187.531	14	.000	.890	.003	.003 - .004
16F	16E + PT2	192.147	17	.000	.893	.003	.003 - .004
16G	16E + PT1	194.226	17	.000	.889	.003	.003 - .004
16H	16G + PT4	200.187	20	.000	.893	.003	.003 - .003
16I	16H + WK	201.215	23	.000	.900	.003	.002 - .003
16J	16I + PC	204.029	26	.000	.914	.003	.002 - .003
16K	16J – WK + AR	202.725	26	.000	.911	.003	.002 - .003
16L	16J – WK + MK	208.351	26	.000	.904	.003	.002 - .003
16M	16L – MK	201.539	23	.000	.898	.003	.002 - .003

Table 110. Chinese Reading Parameter Statistics: ASVAB and DLAB Subtests

		Intercept (I)	Slope (S)			
Model	***Model Variables***	***M***	***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
16A	Base	38.216*	1.888*	12.110*	.483	3.958*
16E	16A + PT3	38.206*	1.896*	11.306*	.558	3.974*
16F	16E + PT2	38.205*	1.896*	11.293*	.557	3.976*
16G	16E + PT1	38.199*	1.891*	11.052*	.550	3.924*

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
16H	16G + PT4	38.205*	1.886*	10.449*	.445	3.774*
16I	16H + WK	38.190*	1.892*	10.267*	.541	3.916*
16J	16I + PC	38.187*	1.900*	10.192*	.461	3.980*
16K	16J – WK + AR	38.193*	1.904*	10.261*	.354	3.941*
16L	16J – WK + MK	38.199*	1.906*	10.269*	.356	3.931*
16M	16L – MK	38.193*	1.902*	10.258*	.371	3.938*

*p < .001 **p < .05

Table 111. Chinese Reading Standardized Regression Weights: ASVAB and DLAB Subtests

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
16E	Intercept	PT3	.854	.131	6.521	< .001
	Slope	PT3	.030	.156	.195	.846
16F	Intercept	PT3	.827	.136	6.073	< .001
	Slope	PT3	.023	.163	.140	.889
	Intercept	PT2	.099	.136	.725	.468
	Slope	PT2	.032	.163	.196	.845
16G	Intercept	PT3	.821	.131	6.291	< .001
	Slope	PT3	.018	.157	.113	.910
	Intercept	PT1	.450	.131	3.442	< .001
	Slope	PT1	.178	.157	1.130	.258
16H	Intercept	PT3	.633	.131	4.818	< .001
	Slope	PT3	-.020	.160	-.123	.902
	Intercept	PT1	.439	.128	3.428	< .001
	Slope	PT1	.173	.156	1.109	.267
	Intercept	PT4	.823	.131	6.274	< .001
	Slope	PT4	.155	.160	.968	.333
16I	Intercept	PT3	.585	.133	4.402	< .001
	Slope	PT3	.017	.164	.101	.919
	Intercept	PT1	.389	.130	2.998	.003**
	Slope	PT1	.223	.160	1.393	.164
	Intercept	PT4	.762	.134	5.698	< .001
	Slope	PT4	.209	.165	1.269	.204
	Intercept	WK	.299	.135	2.208	.027**
	Slope	WK	-.257	.167	-1.541	.123
16J	Intercept	PT3	.566	.133	4.252	< .001
	Slope	PT3	.024	.165	.144	.885
	Intercept	PT1	.374	.130	2.885	.004**

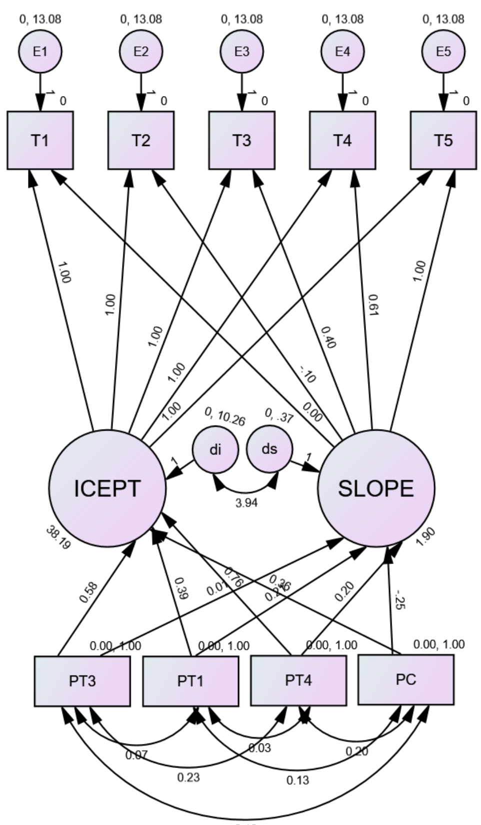
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	PT1	.234	.160	1.456	.145
	Intercept	PT4	.739	.134	5.515	< .001
	Slope	PT4	.225	.166	1.359	.174
	Intercept	WK	.168	.151	1.119	.263
	Slope	WK	-.173	.186	-.928	.354
	Intercept	PC	.285	.148	1.929	.054
	Slope	PC	-.172	.183	-.941	.347
16K	Intercept	PT3	.588	.134	4.399	< .001
	Slope	PT3	.021	.165	.128	.898
	Intercept	PT1	.396	.129	3.069	.002**
	Slope	PT1	.216	.159	1.359	.174
	Intercept	PT4	.772	.138	5.590	< .001
	Slope	PT4	.228	.170	1.338	.181
	Intercept	PC	.369	.137	2.692	.007**
	Slope	PC	-.232	.169	-1.373	.170
	Intercept	AR	-.042	.143	-.293	.769
	Slope	AR	-.086	.176	-.488	.626
16L	Intercept	PT3	.559	.133	4.197	< .001
	Slope	PT3	.015	.164	.094	.925
	Intercept	PT1	.380	.129	2.941	.003**
	Slope	PT1	.211	.159	1.328	.184
	Intercept	PT4	.715	.137	5.216	< .001
	Slope	PT4	.215	.169	1.271	.204
	Intercept	PC	.338	.133	2.538	.011**
	Slope	PC	-.248	.164	-1.507	.132
	Intercept	MK	.186	.136	1.363	.173
	Slope	MK	.014	.086	.168	.866
16M	Intercept	PT3	.583	.132	4.403	< .001
	Slope	PT3	.009	.163	.052	.958
	Intercept	PT1	.393	.129	3.055	.002**
	Slope	PT1	.213	.159	1.344	.179
	Intercept	PT4	.761	.133	5.731	< .001
	Slope	PT4	.205	.164	1.254	.210
	Intercept	PC	.359	.133	2.706	.007**
	Slope	PC	-.254	.164	-1.553	.120

**p < .05

For the final model, 16M, (Figure 51), all residual variances were positive and significant (E1 = 13.080; SE = .373; CR = 35.045, p < .001; E2 = 13.080; SE = .373; CR = 35.045, p < .001; E3 = 13.080; SE = .373; CR = 35.045, p < .001; E4 = 13.080; SE = .373; CR = 35.045, p < .001; E5 = 13.080; SE = .373; CR = 35.045, p < .001). 16M was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 111). DLAB PT4 had the largest regression weight value for the intercept (.761), followed by DLAB PT3 (.583), DLAB PT1, and ASVAB PC (.359). These results suggest that those participants who had higher scores on these subtests were more likely to have higher DLPT reading scores at graduation. None of the subtests had a significant predictive value for the slope.

Figure 51

Path Diagram Chinese Reading: Phase III Model 16M



Phase IV

The same dataset from Chinese Reading Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 16M (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 112.

Table 112. Chinese Reading Descriptive Statistics: Other predictors

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
GPA*	912	3.52	.010	.305	.093	-.384	.081	-.353	.162
AGE*	915	22.65	.109	3.305	10.920	.638	.081	.360	.162
EDUC*	913	4.41	.068	2.042	4.171	.192	.081	-1.426	.162
TRN_HRS*	621	522.13	12.443	310.082	96150.945	.944	.098	1.230	.196
BILLET	746	.52	.018	.500	.250	-.097	.090	-1.996	.179
SEX	949	.73	.014	.444	.197	-1.039	.079	-.922	.159

**Descriptive statistics before standardization*

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The model fit statistics for all models are listed in Table 113, the parameter statistics are listed in Table 114, and the standardized regression weights are listed in Table 115.

Table 113. Chinese Reading Model Fit Statistics: Other Predictors

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
16M	16L – MK	201.539	23	.000	.898	.003	.002 - .003
16N	16M + GPA	202.996	26	.000	.918	.003	.002 - .003
16O	16N – PT3, PT1 + AGE	211.157	23	.000	.911	.003	.002 - .003
16P	16O – AGE + EDUC	205.932	23	.000	.912	.003	.002 - .003
16Q	16P – EDUC + TRN_HRS	193.079	23	.000	.916	.003	.002 - .003
16R	16Q + BILLET	193.420	26	.000	.917	.002	.002 - .003
16S	16Q + SEX	194.438	26	.000	.918	.003	.002 - .003

Table 114. Chinese Reading Parameter Statistics: Other Predictors

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope(S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
16M	16L – MK	38.193*	1.902*	10.258*	.371	3.938*
16N	16M + GPA	38.224*	1.863*	5.904*	.474	2.984*
16O	16N – PT3, PT1 + AGE	38.196*	1.882*	5.819*	.414	3.081*
16P	16O – AGE + EDUC	38.237*	1.855*	6.007*	.386	2.942*
16Q	16P – EDUC + TRN_HRS	38.243*	1.807*	6.043*	.010	2.920*
16R	16Q + BILLET	38.074*	1.790*	6.015*	.031	2.911*
16S	16Q + SEX	38.588*	1.573*	6.034*	.059	2.955*

*p < .001 **p < .05

Table 115. Chinese Reading Standardized Regression Weights: Other Predictors

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
16N	Intercept	PT3	.139	.115	1.211	.226
	Slope	PT3	-.060	.166	-.364	.716
	Intercept	PT1	.051	.111	.457	.648
	Slope	PT1	.163	.160	1.017	.309
	Intercept	PT4	.633	.113	5.595	< .001
	Slope	PT4	.173	.163	1.063	.288
	Intercept	PC	.296	.113	2.616	.009**
	Slope	PC	-.263	.163	-1.609	.108
	Intercept	GPA	2.179	.115	18.975	< .001
	Slope	GPA	.401	.167	2.403	.016**
16O	Intercept	PT4	.656	.112	5.850	< .001
	Slope	PT4	.165	.164	1.005	.315
	Intercept	PC	.345	.117	2.954	.003**
	Slope	PC	-.346	.170	-2.028	.043**
	Intercept	GPA	2.199	.113	19.540	< .001
	Slope	GPA	.452	.165	2.741	.006**
	Intercept	AGE	-.063	.117	-.540	.589
	Slope	AGE	.311	.169	1.843	.065
16P	Intercept	PT4	.650	.112	5.829	< .001
	Slope	PT4	.143	.159	.895	.371
	Intercept	PC	.288	.114	2.533	.011**
	Slope	PC	-.269	.163	-1.655	.098
	Intercept	GPA	2.216	.111	19.962	< .001
	Slope	GPA	.380	.160	2.381	.017**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Intercept	EDUC	.146	.114	1.277	.201
	Slope	EDUC	.104	.162	.642	.521
16Q	Intercept	PT4	.664	.111	5.980	< .001
	Slope	PT4	.167	.156	1.068	.286
	Intercept	PC	.316	.111	2.842	.004**
	Slope	PC	-.228	.156	-1.459	.145
	Intercept	GPA	2.220	.111	19.967	< .001
	Slope	GPA	.414	.157	2.627	.009**
	Intercept	TRN_HRS	-.078	.136	-.574	.566
	Slope	TRN_HRS	.617	.183	3.372	< .001
16R	Intercept	PT4	.664	.111	5.981	< .001
	Slope	PT4	.165	.156	1.058	.290
	Intercept	PC	.311	.111	2.799	.005**
	Slope	PC	-.226	.156	-1.448	.148
	Intercept	GPA	2.219	.111	19.969	< .001
	Slope	GPA	.412	.157	2.622	.009**
	Intercept	TRN_HRS	-.105	.137	-.766	.443
	Slope	TRN_HRS	.602	.185	3.258	.001**
	Intercept	BILLET	.324	.246	1.313	.189
	Slope	BILLET	.030	.340	.087	.930
16S	Intercept	PT4	.684	.111	6.147	< .001
	Slope	PT4	.153	.157	.973	.330
	Intercept	PC	.351	.112	3.120	.002**
	Slope	PC	-.255	.159	-1.606	.108
	Intercept	GPA	2.205	.111	19.779	< .001
	Slope	GPA	.425	.158	2.682	.007**
	Intercept	TRN_HRS	-.084	.136	-.616	.538
	Slope	TRN_HRS	.629	.183	3.432	< .001
	Intercept	SEX	-.466	.249	-1.870	.061
	Slope	SEX	.336	.352	.955	.340

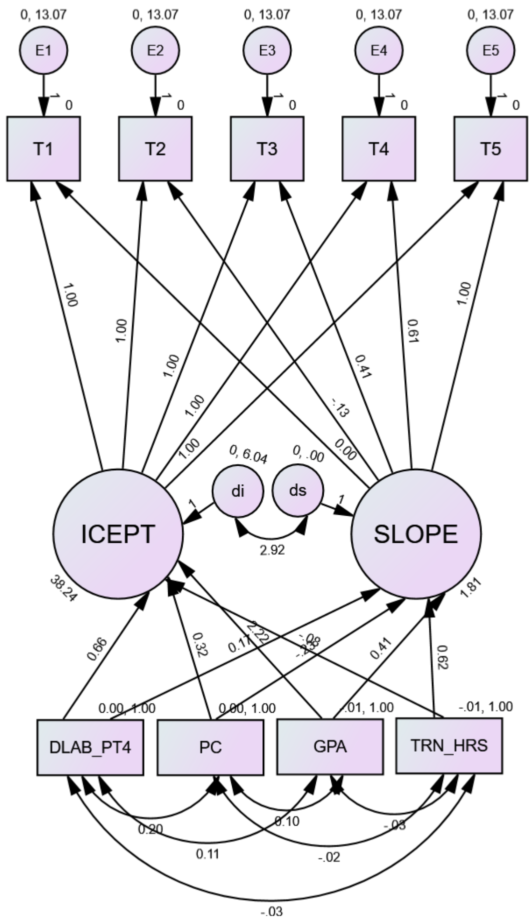
**p < .05

For the final model, 16Q, (Figure 52), all residual variances were positive and significant (E1 = 13.066; SE = .373; CR = 35.018, p < .001; E2 = 13.066; SE = .373; CR = 35.018, p < .001; E3 = 13.066; SE = .373; CR = 35.018, p < .001; E4 = 13.066; SE = .373; CR = 35.018, p < .001; E5 = 13.066; SE = .373; CR = 35.018, p < .001). 16Q was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 115). GPA had the largest significant regression weight on the intercept (2.220), followed by DLAB PT4 (.664), and ADVAB PC (.316). These results suggest that those participants who had higher GPAs at DLI and had higher scores on the DLAB PT4 and ASVAB PC subtests were more likely to have higher DLPT listening scores at graduation. The only predictor with a significant regression weight on the slope was TRN_HRS (.617), implying that those participants who attended more DOD language training experienced slightly more growth in reading language proficiency (as measured by the DLPT) over the five test occasions. AGE, EDUC, BILLET, and SEX were not found to be significant predictors of the intercept or slope in the analysis (see Table 139). There was a significant covariance between several of the predictors (see Appendix).

The results from Phases II, III, and IV for the Chinese DLPT reading suggest that the participants' GPA had the largest positive impact on their performance on the DLPT reading at graduation with those participants with higher GPAs performing better. The participants whose performance was better on the DLAB PT4 and ASVAB PC were also more likely to perform better on the DLPT reading at graduation. The results also suggest that those participants who attended more DOD language training experienced more growth in language proficiency over the five DLPT reading test occasions.

Figure 52

Path Diagram Chinese Reading: Phase IV Model 16Q



Korean Listening

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Korean DLPT listening was 713 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Korean listening sample are shown in Table 116. 72.5% of the sample had four test occasions, and 46.6% had five test occasions. Figure 53 displays the mean DLPT listening scores at each test occasion. The average listening proficiency decreased between Time1 and Time2, increased between Time2 and Time3, decreased between Time3 and Time4, and increased between Time4 and Time5. Overall, mean growth was minimal. The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Korean listening scores at all test occasions are slightly positively skewed and that the scores are slightly platykurtic or slightly leptokurtic.

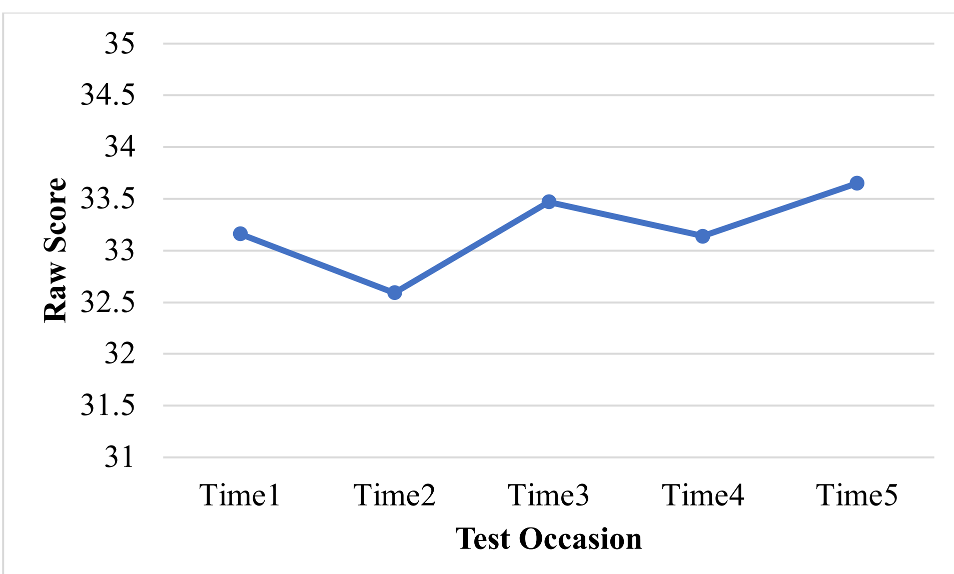
Table 116. Korean Listening Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	713	33.16	.230	6.144	37.745	.327	.092	-.014	.183
Time2	713	32.59	.252	6.742	45.451	.169	.092	.006	.183
Time3	713	33.47	.257	6.856	47.002	.112	.092	-.206	.183
Time4	517	33.14	.284	6.450	41.608	.318	.107	-.156	.214
Time5	332	33.65	.339	6.174	38.114	.211	.134	-.034	.267
APT*	713	122.27	.410	10.944	119.777	.247	.092	.016	.183
COG*	713	92.14	.274	7.329	53.715	-1.632	.092	2.956	.183
ATT*	574	4.10	.039	.923	.851	-.878	.102	.671	.204

****Descriptive statistics before standardization***

Figure 53

Mean DLPT Listening Scores by Test Occasion: Korean



Two growth models, linear and non-linear were compared. The linear model, Model 17AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 17A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 17A indicated a better model fit (χ^2= 50.528, *df* = 13, *p* = .00; CFI = .978; RMSEA = .002, CI = .001-.002) than Model 17AA (χ^2= 71.231, *df* = 16 , *p* = .00; CFI = .968; RMSEA = .002, CI = .001-.002). Therefore, Model 17A was accepted as the base model.

For Model 17A, the mean slope was positive and significant (*M* = 1.332, $p < .001$) indicating that the Korean DLPT listening scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 33.079, $p < .001$). The covariance between the slope and the intercept was set to a constant, 1.0. The slope variance was set to a constant, 1.0, so the model would converge. The intercept variance (29.132, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial Korean DLPT Listening score. Table 118 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all ILR Category IV languages. The model fit statistics for all models are listed in Table 117, the parameter statistics are listed in Table 118, and the standardized regression weights are listed in Table 119.

Table 117. Korean Listening Model Fit Statistics

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
17A	Base	50.528	13	.000	.978	.002	.001 - .002

17B	17A + APT	58.489	16	.000	.976	.002	.001 - .002
17C	17B + COG	72.850	19	.000	.971	.002	.001 - .002
17D	17C + ATT	74.323	22	.000	.972	.002	.001 - .002

Table 118. Korean Listening Parameter Statistics

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
17A	Base	33.079*	1.332*	29.132*	1.00	1.00
17B	17A + APT	33.085*	1.325*	28.967*	1.00	1.00
17C	17B + COG	33.538*	-.217**	24.775*	1.00	1.00
17D	17C + ATT	33.532*	-.211**	24.687*	1.00	1.00

*p < .001 **p < .05

Table 119. Korean Listening Standardized Regression Weights

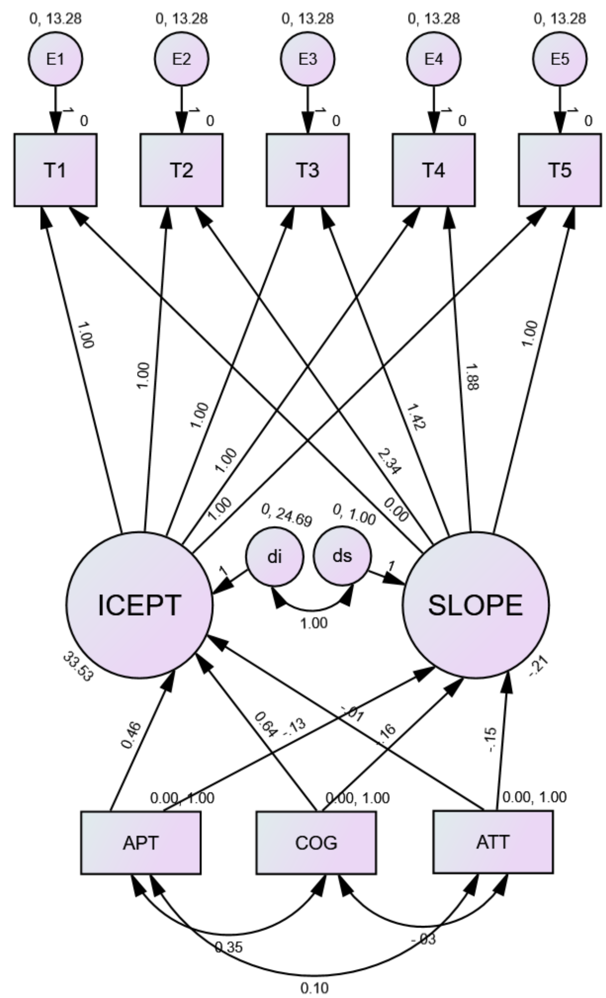
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
17B	Intercept	APT	.417	.215	1.942	.052
	Slope	APT	.047	.183	.258	.797
17C	Intercept	APT	.461	.239	1.929	.054
	Slope	APT	-.149	.094	-1.597	.110
	Intercept	COG	.645	.239	2.699	.007**
	Slope	COG	-.150	.094	-1.603	.109
17D	Intercept	APT	.465	.241	1.928	.054
	Slope	APT	-.131	.094	-1.392	.164
	Intercept	COG	.644	.240	2.685	.007**
	Slope	COG	-.159	.094	-1.684	.092
	Intercept	ATT	-.014	.251	-.057	.955
	Slope	ATT	-.152	.099	-1.536	.124

**p < .05

For the final model, Model 17D (Figure 54), the residual variances were all positive and significant (E1 = 13.279; *SE* = .433, CR = 18.881, $p < .001$; E2 = 13.279; *SE* = .433, CR = 18.881, $p < .001$; E3 = 13.279; *SE* = .433, CR = 18.881, $p < .001$; E4 = 13.279; *SE* = .433, CR = 18.881, $p < .001$; E5 = 13.279; *SE* = .433, CR = 18.881, $p < .001$). COG was a significant predictor of the intercept; general cognitive aptitude predicted the initial Korean Listening scores. The covariance between APT and COG is also significant. COG and ATT were not significant predictors of the intercept and none of the predictors were significant predictors of the slope. This is not surprising due to the very limited amount of growth in the Korean listening population.

Figure 54

Path Diagram Korean Listening: Phase II Model 17D



Phase III

The same dataset from Korean Listening Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time.

ATT was not added to the model as it was not significant in Phase II. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 120.

Table 120. Korean Listening Descriptive Statistics: ASVAB and DLAB Subtests

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
ASVAB_WK*	713	62.08	.230	6.147	37.782	-.261	.092	.162	.183
ASVAB_PC*	713	62.25	.177	4.722	22.301	-.515	.092	-.156	.183
ASVAB_AR*	713	63.62	.188	5.029	25.289	-.577	.092	.636	.183
ASVAB_MK*	713	64.04	.183	4.897	23.983	-.317	.092	-.122	.183
DLAB_PT1*	713	3.19	.059	1.580	2.496	.117	.092	-.654	.183
DLAB_PT2*	713	13.67	.105	2.814	7.920	-.548	.092	-.353	.183
DLAB_PT3*	713	48.60	.204	5.455	29.753	-.012	.092	-.087	.183
DLAB_PT4*	713	20.85	.138	3.697	13.664	-.323	.092	-.223	.183

Descriptive statistics before standardization

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for DLI Language Category IV languages. When a subtest was not a significant predictor, it was excluded from the next model. The model fit statistics for all models are listed in Table 121, the parameter statistics are listed in Table 122, and the standardized regression weights are listed in Table 123.

Table 121. Korean Listening Model Fit Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
17A	Base	50.528	13	.000	.978	.002	.001 - .002
17E	17A + PT3	55.567	16	.000	.963	.002	.001 - .002
17F	17A+ PT2	52.753	16	.000	.979	.001	.001 - .002
17G	17A + PT1	73.539	16	.000	.967	.002	.001 - .002
17H	17G + PT4	75.052	19	.000	.968	.002	.001 - .002
17I	17H – PT1 + WK	60.373	19	.000	.976	.001	.001 - .002
17J	17I – WK + PC	74.735	19	.000	.969	.002	.001 - .002
17K	17J + AR	75.147	22	.000	.971	.002	.001 - .002
17L	17K + MK	80.697	25	.000	.974	.001	.001 - .002
17M	17L – AR	77.960	22	.000	.969	.002	.001 - .002

Table 122. Korean Listening Parameter Statistics: ASVAB and DLAB Subtests

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
17A	Base	33.079*	1.332*	29.132*	1.00	1.00
17E	17A + PT3	33.072*	1.340*	29.114*	1.00	1.00
17F	17A + PT2	33.074*	1.335*	29.097*	1.00	1.00
17G	17A + PT1	33.523*	-.206**	24.768*	1.00	1.00
17H	17G + PT4	33.538*	-.221**	24.6291	1.00	1.00
17I	17H – PT1 + WK	33.109*	1.303**	28.935*	1.00	1.00
17J	17I – WK + PC	33.543*	-.219**	24.680*	1.00	1.00
17K	17J + AR	33.542*	-.217*	24.431*	1.00	1.00
17L	17K + MK	33.546*	-.223*	24.207*	1.00	1.00
17M	17L – AR	33.548*	-.225*	24.266*	1.00	1.00

*p < .001 **p < .05

Table 123. Korean Listening Standardized Regression Weights: ASVAB and DLAB Subtests

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
17E	Intercept	PT3	.069	.215	.319	.750
	Slope	PT3	-.035	.186	-.191	.849
17F	Intercept	PT2	.160	.215	.745	.456
	Slope	PT2	-.036	.185	-.196	.844
17G	Intercept	PT1	.478	.225	2.123	.034**
	Slope	PT1	.148	.091	1.632	.103
17H	Intercept	PT1	.438	.224	1.954	.051
	Slope	PT1	.159	.091	1.749	.080
	Intercept	PT4	.728	.224	3.246	.001**
	Slope	PT4	-.208	.092	-2.259	.024**
17I	Intercept	PT4	.508	.217	2.339	.019**
	Slope	PT4	.083	.183	.455	.649
	Intercept	WK	-.119	.218	-.549	.583
	Slope	WK	.154	.184	.837	.403
17J	Intercept	PT4	.626	.227	2.758	.006**
	Slope	PT4	-.153	.089	-1.721	.085
	Intercept	PC	.683	.227	3.005	.003**
	Slope	PC	-.201	.090	-2.238	.025**
17K	Intercept	PT4	.488	.233	2.095	.036**
	Slope	PT4	-.133	.091	-1.471	.141
	Intercept	PC	.554	.232	2.384	.017**
	Slope	PC	-.183	.091	-2.006	.045**

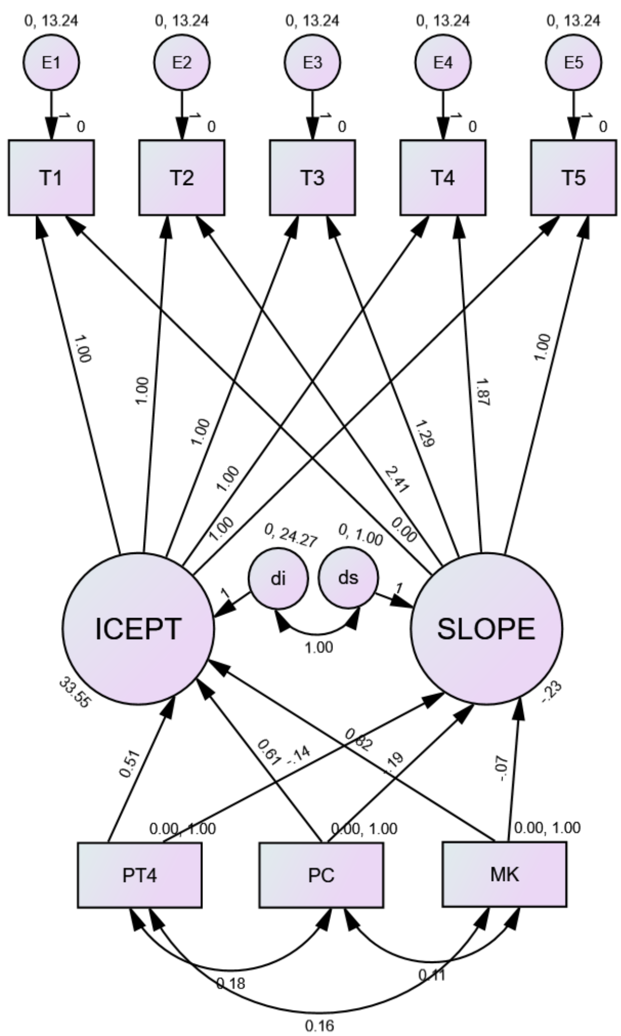
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Intercept	AR	.589	.237	2.483	.013**
	Slope	AR	-.079	.092	-.862	.389
17L	Intercept	PT4	.476	.232	2.056	.040**
	Slope	PT4	-.134	.090	-1.482	.138
	Intercept	PC	.577	.231	2.495	.013**
	Slope	PC	-.185	.091	-2.022	.043**
	Intercept	AR	.188	.278	.675	.499
	Slope	AR	-.056	.107	-.524	.600
	Intercept	MK	.721	.265	2.722	.006**
	Slope	MK	-.040	.102	-.392	.695
17M	Intercept	PT4	.506	.227	2.224	.026**
	Slope	PT4	-.143	.089	-1.612	.107
	Intercept	PC	.608	.226	2.692	.007**
	Slope	PC	-.194	.089	-2.169	.030**
	Intercept	MK	.819	.225	3.645	< .001
	Slope	MK	-.071	.087	-.818	.414

**$p < .05$

For the final model, 17M, (Figure 55), all residual variances were positive and significant (E1 = 13.236; SE = .432; CR = 30.605, $p < .001$; E2 = 13.236; SE = .432; CR = 30.605, $p < .001$; E3 = 13.236; SE = .432; CR = 30.605, $p < .001$; E4 = 13.236; SE = .432; CR = 30.605, $p < .001$; E5 = 13.236; SE = .432; CR = 30.605, $p < .001$). 17M was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 123). ASVAB MK had the largest regression weight value for the intercept (.819), followed by ASVAB PC (.608), and DLAB PT4 (.506). These results suggest that those participants who had higher scores on these subtests were more likely to have higher DLPT listening scores at graduation. The only subtest that had a significant predictive value for the slope was ASVAB PC and it was negative (-.194), implying that those participants who had lower scores on the ASVAB PC experienced slightly more growth in language proficiency over the five test occasions.

Figure 55

Path Diagram Korean Listening: Phase III Model 17M



Phase IV

The same dataset from Korean Listening Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 15L (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 124.

Table 124. Korean Listening Descriptive Statistics: Other predictors

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
GPA*	649	3.58	.011	.281	.079	-.842	.096	2.035	.192
AGE*	571	22.07	.134	3.203	10.262	1.347	.102	3.245	.204
EDUC*	570	4.10	.084	2.009	4.037	.454	.102	-1.325	.204
TRN_HRS*	353	281.76	12.379	232.572	54089.591	1.005	.130	.916	.259
BILLET	498	.45	.022	.498	.248	.186	.109	-1.973	.218
SEX	713	.74	.016	.439	.192	-1.100	.092	-.793	.183

Descriptive statistics before standardization

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The model fit statistics for all models are listed in Table 125, the parameter statistics are listed in Table 126, and the standardized regression weights are listed in Table 127.

Table 125. Korean Listening Model Fit Statistics: Other Predictors

Model	***Model Variables***	χ^2	*df*	*P*	**CFI**	**RMSEA**	**CI**
17M	17L – AR	77.960	22	.000	.969	.002	.001 - .002
17N	17M + GPA	78.660	25	.000	.973	.001	.001 - .002
17O	17N – PT4, MK + AGE	77.848	22	.000	.971	.002	.001 - .002
17P	17O + EDUC	79.542	25	.000	.976	.001	.001 - .002
17Q	17O + TRN_HRS	81.520	25	.000	.971	.001	.001 - .002
17R	17O + BILLET	80.531	25	.000	.949	.001	.001 - .002
17S	17O + SEX	86.637	25	.000	.969	.002	.001 - .002

Table 126. Korean Listening Parameter Statistics: Other Predictors

Model	***Model Variables***	**Intercept (I) *M***	**Slope (S) *M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
17M	17L – AR	33.548*	-.225**	24.266*	1.00	1.00
17N	17M + GPA	33.575*	-.217**	16.280*	1.00	1.00
17O	17N – PT4, MK + AGE	33.555*	-.203**	16.290*	1.00	1.00
17P	17O + EDUC	33.555*	-.201**	16.288*	1.00	1.00
17Q	17O + TRN_HRS	33.563*	-.202**	16.080*	1.00	1.00
17R	17O + BILLET	33.346*	-.248	16.237*	1.00	1.00
17S	17O + SEX	33.418*	-.116	16.399*	1.00	1.00

*p < .001 **p < .05

Table 127. Korean Listening Standardized Regression Weights: Other Predictors

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***p***
17N	Intercept	PT4	.333	.203	1.641	.101
	Slope	PT4	-.146	.090	-1.610	.107
	Intercept	PC	.264	.203	1.301	.193
	Slope	PC	-.201	.092	-2.199	.028**
	Intercept	MK	.344	.203	1.693	.090
	Slope	MK	-.070	.090	-.784	.433
	Intercept	GPA	2.843	.205	13.833	< .001
	Slope	GPA	.016	.092	.177	.860
17O	Intercept	PC	.421	.203	2.073	.038**
	Slope	PC	-.263	.094	-2.809	.005**
	Intercept	GPA	2.914	.203	14.328	< .001
	Slope	GPA	-.004	.091	-.041	.967
	Intercept	AGE	-.512	.222	-2.305	.021**
	Slope	AGE	.227	.101	2.249	.024**
17P	Intercept	PC	.444	.205	2.168	.030**
	Slope	PC	-.275	.095	-2.912	.004**
	Intercept	GPA	2.927	.204	14.373	< .001
	Slope	GPA	-.013	.091	-.143	.887
	Intercept	AGE	-.360	.280	-1.285	.199
	Slope	AGE	.154	.124	1.237	.216
	Intercept	EDUC	-.253	.283	-.893	.372
	Slope	EDUC	.133	.125	1.058	.290
17Q	Intercept	PC	.430	.203	2.119	.034**
	Slope	PC	-.263	.094	-2.787	.005**
	Intercept	GPA	2.900	.204	14.246	< .001
	Slope	GPA	-.006	.092	-.064	.949
	Intercept	AGE	-.472	.224	-2.109	.035**
	Slope	AGE	.238	.103	2.307	.021**
	Intercept	TRN_HRS	-.405	.280	-1.448	.148
	Slope	TRN_HRS	-.079	.125	-.634	.526
17R	Intercept	PC	.428	.203	2.110	.035**
	Slope	PC	-.262	.094	-2.794	.005**
	Intercept	GPA	2.895	.204	14.175	< .001
	Slope	GPA	-.008	.092	-.086	.931
	Intercept	AGE	-.520	.222	-2.343	.019**
	Slope	AGE	.228	.101	2.252	.024**
	Intercept	BILLET	.462	.476	.971	.331

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	BILLET	.098	.211	.463	.643
17S	Intercept	PC	.412	.203	2.024	.043**
	Slope	PC	-.258	.094	-2.760	.006**
	Intercept	GPA	2.920	.204	14.338	< .001
	Slope	GPA	-.010	.091	-.108	.914
	Intercept	AGE	-.514	.223	-2.309	.021**
	Slope	AGE	.231	.101	2.276	.023**
	Intercept	SEX	.193	.456	.424	.672
	Slope	SEX	-.127	.201	-.630	.529

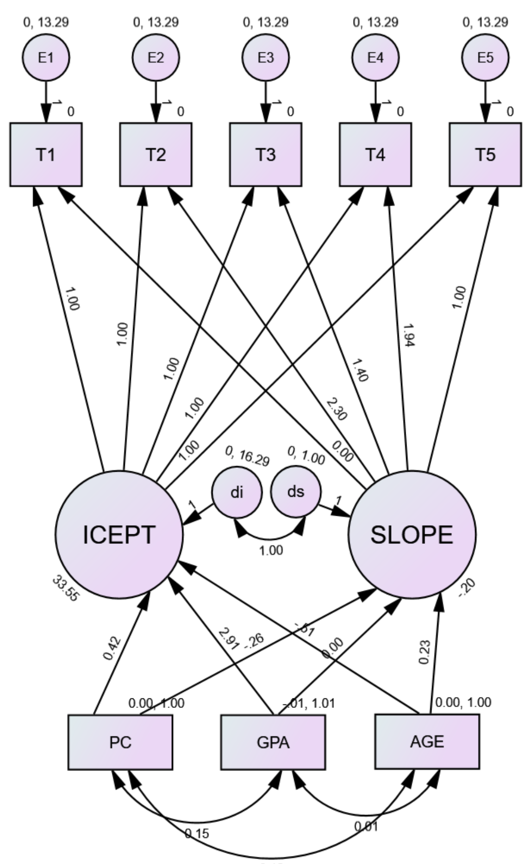
**p < .05

For the final model, 17O, (Figure 56), all residual variances were positive and significant (E1 = 13.287; SE = .427; CR = 31.124, p < .001; E2 = 13.287; SE = .427; CR = 31.124, p < .001; E3 = 13.287; SE = .427; CR = 31.124, p < .001; E4 = 13.287; SE = .427; CR = 31.124, p < .001; E5 = 13.287; SE = .427; CR = 31.124, p < .001). 17O was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 127). GPA had the largest significant regression weight on the intercept (2.914), followed by AGE (-.512), although the weight was negative, and ASVAB PC (.421). These results suggest that those participants who had higher GPAs at DLI, were younger when beginning their studies at DLI, and had higher scores on the ASVAB PC subtest were more likely to have higher DLPT listening scores at graduation. ASVAB PC had the largest significant predictive value for the slope (-.263), although the weight was negative, followed by AGE (.227) implying that those participants who were older when they attended DLI and who did not perform as well on the ASVAB PC were more likely to experience growth in listening language proficiency (as measured by the DLPT) over the five test occasions. EDUC, TRN_HRS, BILLET, and SEX were not found to be significant predictors of the intercept or slope in the analysis. There was a significant covariance between several of the predictors (see Appendix).

The results from Phases II, III, and IV for the Korean DLPT listening suggest that the participants' GPA had the largest positive impact on their performance on the DLPT listening at graduation. The participants whose performance on the ASVAB PC was better were more likely to perform better on the DLPT listening at graduation. In addition, participants who were younger when beginning their studies at DLI were more likely to have higher scores on the DLPT listening at graduation. However, the results also suggest that those participants who did not perform as well on the ASVAB PC and who were older while attending DLI were most likely to experience growth in listening language proficiency over the five test occasions.

Figure 56

Path Diagram Korean Listening: Phase IV Model 17O



Korean Reading

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Korean DLPT reading was 711 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Korean reading sample are shown in Table 128. 72.3% of the sample had four test occasions, and 46.1% had five test occasions. Figure 57 displays the mean DLPT reading scores at each test occasion. The average listening proficiency decreased between Time1 and Time2 but then increased from one test occasion to the next. The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Korean reading scores at all test occasions are slightly negatively skewed and that the scores are slightly leptokurtic or platykurtic.

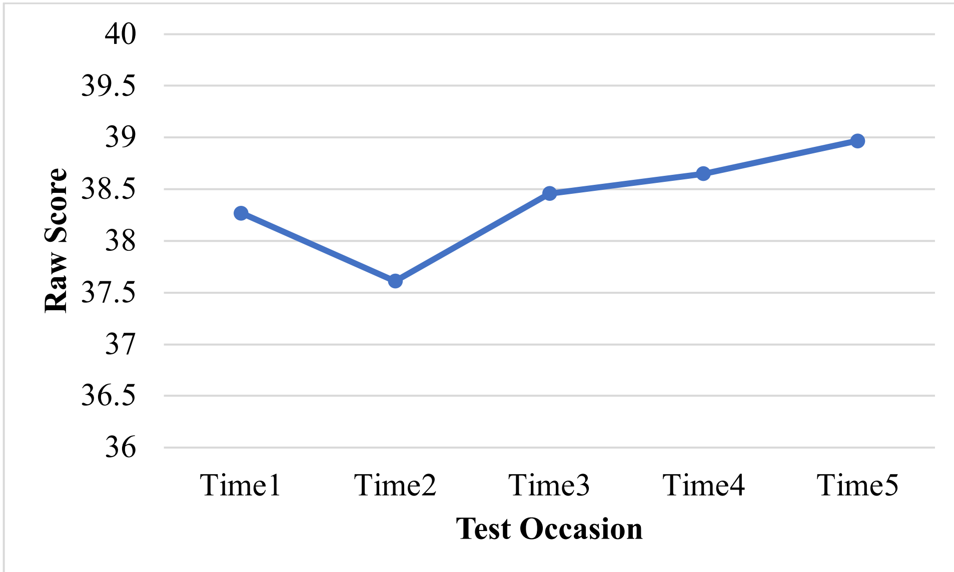
Table 128. Korean Reading Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	711	38.27	.193	5.152	26.547	-.258	.092	.077	.183
Time2	711	37.61	.208	5.542	30.717	-.254	.092	.134	.183
Time3	711	38.46	.218	5.817	33.834	-.486	.092	.557	.183
Time4	514	38.65	.242	5.480	30.026	-.445	.108	.396	.215
Time5	328	38.97	.297	5.378	28.920	-.265	.135	-.085	.268
APT*	711	122.26	.411	10.947	119.831	.248	.092	.020	.183
COG*	711	92.15	.275	7.327	53.689	-1.638	.092	2.980	.183
ATT*	572	4.11	.039	.922	.850	-.889	.102	.703	.204

Descriptive statistics before standardization

Figure 57

Mean DLPT Reading Scores by Test Occasion: Korean



Two growth models, linear and non-linear were compared. The linear model, Model 18AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 18A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 18A indicated a better model fit (χ^2= 101.072, *df* = 11, *p* = .00; CFI = .921; RMSEA = .003, CI = .002-.003) than Model 18AA (χ^2= 109.012, *df* = 14 , *p* = .00; CFI = .917; RMSEA = .003, CI = .002-.003). Therefore, Model 18A was accepted as the base model.

For Model 18A, the mean slope was positive and significant (*M* = 1.268, *p* < .001) indicating that the Korean DLPT reading scores increased slightly (given the small value) over time. The mean intercept was significant (*M* = 37.953, *p* < .001). The covariance between the slope and the intercept was significant (3.163, *p* < .001) implying that those participants who had higher DLPT scores at graduation experienced more growth over the five test occasions. The slope variance was not significant (1.255, $p > .05$), indicating that there were not significant inter-participant differences in terms of growth on Korean DLPT Reading over the five test occasions. The intercept variance (14.818, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial Korean DLPT Reading score. Table 130 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Language Difficulty Category IV languages (See Chapter 5). The model fit statistics for all models are listed in Table 129, the parameter statistics are listed in Table 130, and the standardized regression weights are listed in Table 131.

Table 129. Korean Reading Model Fit Statistics

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
18A	Base	101.072	11	.000	.921	.003	.002 - .003
18B	18A + APT	105.441	14	.000	.922	.003	.002 - .003
18C	18B + COG	106.618	17	.000	.931	.002	.002 - .003
18D	18C + ATT	108.062	20	.000	.932	.002	.002 - .002

Table 130. Korean Reading Parameter Statistics

Model	***Model Variables***	**Intercept (I) *M***	**Slope (S) *M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
18A	Base	37.953*	1.268*	14.818*	1.255	3.163
18B	18A + APT	37.891*	.822*	11.968*	5.357**	2.591
18C	18B + COG	37.893*	.815*	11.094*	5.471**	2.651**
18D	18C + ATT	37.892*	.818*	11.090*	5.438**	2.664**

*p < .001 **p < .05

Table 131. Korean Reading Standardized Regression Weights

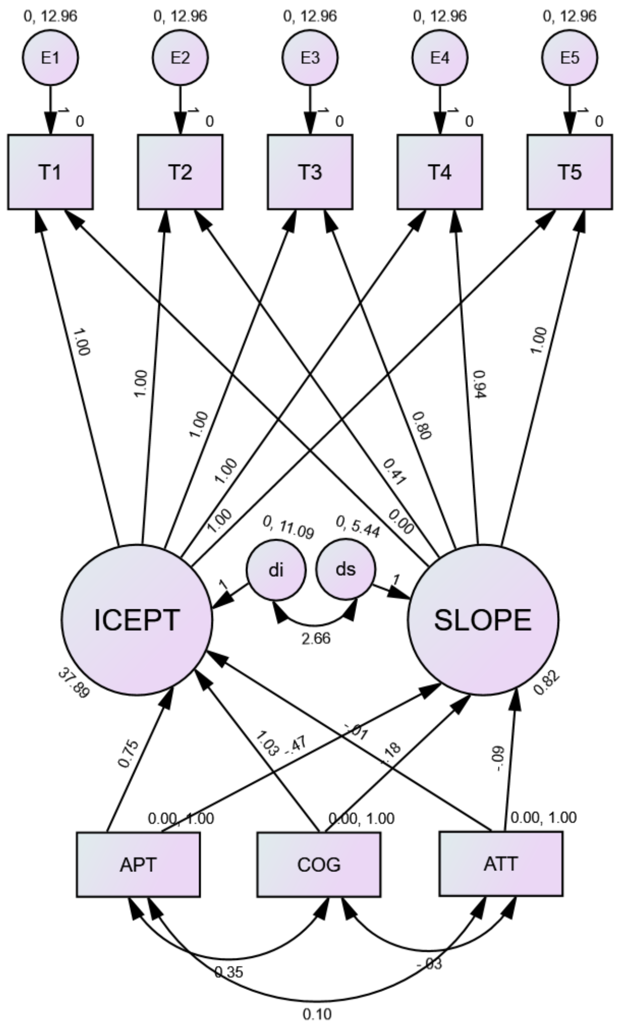
Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
18B	Intercept	APT	1.108	.177	6.247	< .001
	Slope	APT	-.537	.209	-2.568	.010**
18C	Intercept	APT	.754	.185	4.068	< .001
	Slope	APT	-.479	.221	-2.168	.030**
	Intercept	COG	1.027	.185	5.559	< .001
	Slope	COG	-.177	.217	-.814	.416
18D	Intercept	APT	.755	.187	4.040	< .001
	Slope	APT	-.468	.223	-2.101	.036**
	Intercept	COG	1.025	.185	5.537	< .001
	Slope	COG	-.181	.218	-.833	.405
	Intercept	ATT	-.012	.194	-.061	.951
	Slope	ATT	-.090	.229	-.394	.694

**p < .05

For the final model, Model 18D (Figure 58), the residual variances were all positive and significant (E1 = 12.956; *SE* = .459, CR = 28.207, $p < .001$; E2 = 12.956; *SE* = .459, CR = 28.207, $p < .001$; E3 = 12.956; *SE* = .459, CR = 28.207, $p < .001$; E4 = 12.956; *SE* = .459, CR = 28.207, $p < .001$; E5 = 12.956; *SE* = .459, CR = 28.207, $p < .001$). APT and COG were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial Korean reading scores. COG was a stronger predictor (1.025) than APT (.755), which goes against the prediction based on the literature that APT would be a stronger predictor of Category IV languages. APT was a significant predictor of the slope; however, the weight is negative (-.468), implying that those who received lower scores on the DLAB were more likely to experience growth over the five DLPT test occasions.

Figure 58

Path Diagram Korean Reading: Phase II Model 18D



Phase III

The same dataset from Korean Reading Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 132.

Table 132. Korean Reading Descriptive Statistics: ASVAB and DLAB Subtests

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
ASVAB_WK*	711	62.11	.230	6.132	37.607	-.257	.092	.165	.183
ASVAB_PC*	711	62.25	.177	4.724	22.314	-.517	.092	-.152	.183
ASVAB_AR*	711	63.62	.189	5.034	25.341	-.574	.092	.628	.183
ASVAB_MK*	711	64.03	.184	4.894	23.955	-.320	.092	-.119	.183
DLAB_PT1*	711	3.19	.059	1.580	2.497	.117	.092	-.651	.183
DLAB_PT2*	711	13.67	.106	2.815	7.926	-.547	.092	-.356	.183
DLAB_PT3*	711	48.61	.205	5.457	29.775	-.015	.092	-.086	.183
DLAB_PT4*	711	20.84	.139	3.695	13.651	-.320	.092	-.220	.183

Descriptive statistics before standardization

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for DLI Language Difficulty Category IV languages. The subtests were entered in the same order as they were for the Korean listening analysis. When a subtest was not a significant predictor, it was excluded from the next model. The model fit statistics for all models are listed in Table 133, the parameter statistics are listed in Table 134, and the standardized regression weights are listed in Table 135.

Table 133. Korean Reading Model Fit Statistics: ASVAB and DLAB Subtests

Model	*Model Variables*	χ^2	*df*	*P*	CFI	RMSEA	CI
18A	Base	101.072	11	.000	.921	.003	.002 - .003
18E	18A + PT3	107.232	14	.000	.920	.003	.002 - .003
18F	18E + PT2	107.590	17	.000	.924	.002	.002 - .003
18G	18E + PT1	110.686	18	.000	.920	.002	.002 - .003
18H	18G + PT4	116.551	20	.000	.921	.002	.002 - .003
18I	18H + WK	117.112	23	.000	.928	.002	.002 - .002
18J	18H + PC	116.939	23	.000	.927	.002	.002 - .002
18K	18J + AR	119.337	26	.000	.933	.002	.002 - .002
18L	18K – PT3 + MK	115.990	26	.000	.944	.002	.001 - .002

Table 134. Korean Reading Parameter Statistics: ASVAB and DLAB Subtests

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
18A	Base	37.953*	1.268*	14.818*	1.255	3.163**

18E	18A + PT3	37.886*	.836*	12.533*	4.981**	2.530**
18F	18E + PT2	37.885*	.841*	12.525*	4.950**	2.549**
18G	18E + PT1	37.879*	.873*	12.310*	4.643**	2.571**
18H	18G + PT4	37.889*	.847*	11.662*	5.346**	2.725*
18I	18H + WK	37.897*	.819*	11.563*	5.515**	2.612*
18J	18H + PC	37.888*	.852*	11.210*	5.360**	2.760**
18K	18J + AR	37.869*	.936*	10.689*	4.815**	3.304**
18L	18K – PT3 + MK	37.849*	1.124*	10.837*	3.626	3.835*

*p < .001 **p < .05

Table 135. Korean Reading Standardized Regression Weights: ASVAB and DLAB Subtests

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
18E	Intercept	PT3	.784	.179	4.387	< .001
	Slope	PT3	-.466	.205	-2.277	.023**
18F	Intercept	PT3	.754	.184	4.090	< .001
	Slope	PT3	-.462	.211	-2.191	.028**
	Intercept	PT2	.115	.183	.628	.530
	Slope	PT2	-.012	.206	-.058	.954
18G	Intercept	PT3	.722	.178	4.048	< .001
	Slope	PT3	-.488	.207	-2.363	.018
	Intercept	PT1	.483	.178	2.720	.007**
	Slope	PT1	.269	.202	1.329	.184
18H	Intercept	PT3	.575	.181	3.178	.001**
	Slope	PT3	-.414	.216	-1.912	.056
	Intercept	PT1	.434	.177	2.451	.014**
	Slope	PT1	.315	.211	1.493	.135
	Intercept	PT4	.825	.180	4.572	< .001
	Slope	PT4	-.518	.217	-2.384	.017**
18I	Intercept	PT3	.497	.187	2.657	.008**
	Slope	PT3	-.403	.223	-1.807	.071
	Intercept	PT1	.386	.179	2.152	.031**
	Slope	PT1	.324	.213	1.519	.129
	Intercept	PT4	.792	.182	4.352	< .001
	Slope	PT4	-.511	.218	-2.339	.019**
	Intercept	WK	.329	.187	1.755	.079
	Slope	WK	-.057	.221	-.257	.798
18J	Intercept	PT3	.463	.181	2.554	.011**
	Slope	PT3	-.405	.219	-1.846	.065
	Intercept	PT1	.390	.176	2.218	.027**

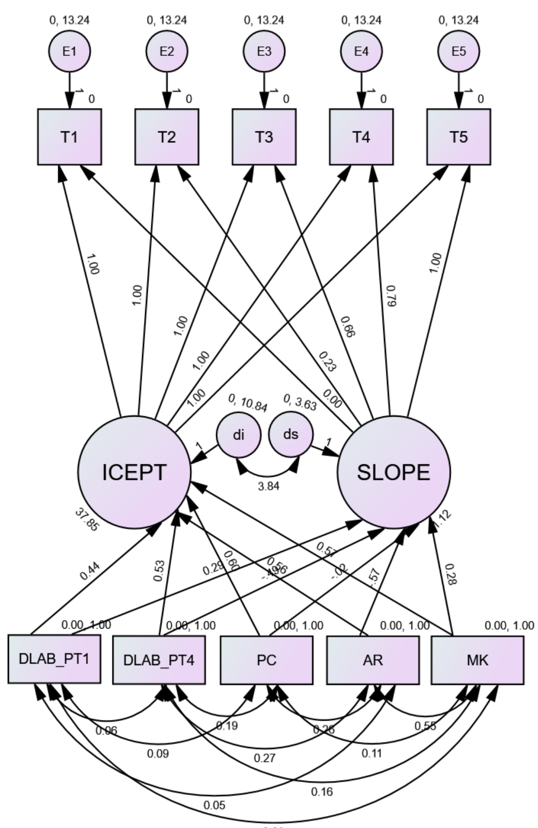
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	PT1	.319	.212	1.506	.132
	Intercept	PT4	.719	.181	3.985	< .001
	Slope	PT4	-.512	.220	-2.327	.020**
	Intercept	PC	.708	.180	3.938	< .001
	Slope	PC	-.055	.215	-.254	.799
18K	Intercept	PT3	.332	.178	1.864	.062
	Slope	PT3	-.343	.221	-1.553	.120
	Intercept	PT1	.394	.172	2.298	.022**
	Slope	PT1	.317	.212	1.493	.135
	Intercept	PT4	.528	.180	2.930	.003**
	Slope	PT4	-.441	.224	-1.968	.049**
	Intercept	PC	.540	.179	3.014	.003**
	Slope	PC	.008	.220	.037	.970
	Intercept	AR	.856	.183	4.670	< .001
	Slope	AR	-.352	.227	-1.555	.120
18L	Intercept	PT1	.442	.167	2.645	.008**
	Slope	PT1	.292	.214	1.366	.172
	Intercept	PT4	.534	.175	3.051	.002**
	Slope	PT4	-.492	.225	-2.180	.029**
	Intercept	PC	.602	.174	3.466	< .001
	Slope	PC	-.024	.222	-.107	.915
	Intercept	AR	.564	.210	2.685	.007**
	Slope	AR	-.566	.271	-2.091	.037**
	Intercept	MK	.571	.199	2.869	.004**
	Slope	MK	.276	.255	1.083	.279

**p < .05

For the final model, 18L, (Figure 59), all residual variances were positive and significant (E1 = 13.235; SE = .463; CR = 25.585, p < .001; E2 = 13.235; SE = .463; CR = 25.585, p < .001; E3 = 13.235; SE = .463; CR = 25.585, p < .001; E4 = 13.235; SE = .463; CR = 25.585, p < .001; E5 = 13.235; SE = .463; CR = 25.585, p < .001). 18L was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 135). ASVAB PC had the largest regression weight value for the intercept (.602), followed by ASVAB MK (.571), ASVAB AR (.564), DLAB PT4 (.534), and DLAB PT1 (.442). These results suggest that those participants who had higher scores on these subtests were more likely to have higher DLPT reading scores at graduation. ASVAB AR (-.566) and DLAB PT4 (-.492) both had significant predictive values for the slope; however, both were negative, suggesting that those participants who had lower scores on these subtests were more likely to experience growth in language proficiency over the five test occasions.

Figure 59

Path Diagram Korean Reading: Phase III Model 18L



Phase IV

The same dataset from Korean Reading Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 18L (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 136.

Table 136. Korean Reading Descriptive Statistics: Other predictors

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
GPA*	648	3.58	.011	.280	.079	-.847	.096	2.068	.192
AGE*	569	22.05	.133	3.182	10.122	1.344	.102	3.304	.204
EDUC*	568	4.10	.084	2.011	4.045	.457	.103	-1.324	.205
TRN_HRS*	353	281.76	12.379	232.572	54089.591	1.005	.130	.916	.259
BILLET	497	.45	.022	.498	.248	.191	.110	-1.972	.219
SEX	711	.74	.016	.439	.193	-1.095	.092	-.802	.183

Descriptive statistics before standardization

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The model fit statistics for all models are listed in Table 137, the parameter statistics are listed in Table 138, and the standardized regression weights are listed in Table 139.

Table 137. Korean Reading Model Fit Statistics: Other Predictors

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
18L	18K – PT3 + MK	115.990	26	.000	.944	.002	.001 - .002
18M	18L + GPA	120.258	29	.000	.950	.002	.001 - .002
18N	18M – PT1, MK + AGE	116.962	26	.000	.940	.002	.002 - .002
18O	18N + EDUC	120.482	29	.000	.949	.002	.001 - .002
18P	18N + TRN_HRS	120.053	29	.000	.940	.002	.001 - .002
18Q	18N + BILLET	117.262	29	.000	.942	.002	.001 - .002
18R	18N + SEX	119.141	29	.000	.943	.002	.001 - .002

Table 138. Korean Reading Parameter Statistics: Other Predictors

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope(S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
18L	18K – PT3 + MK	37.849*	1.124*	10.837*	3.626	3.835*
18M	18L + GPA	37.951*	.765*	7.022*	5.890**	2.140
18N	18M – PT1, MK + AGE	38.002*	.629**	7.191*	6.291**	1.563

18O	18N + EDUC	38.022*	.588*	7.098*	6.304**	1.443
18P	18N + TRN_HRS	38.002*	.632**	7.176*	6.304**	1.558
18Q	18N + BILLET	37.771*	.619**	7.130*	6.284**	1.557
18R	18N + SEX	38.179*	.712	7.177*	6.274**	1.608

*p < .001 **p < .05

Table 139. Korean Reading Standardized Regression Weights: Other Predictors

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
18M	Intercept	PT1	.014	.164	.085	.932
	Slope	PT1	.278	.215	1.292	.196
	Intercept	PT4	.506	.168	3.015	.003**
	Slope	PT4	-.502	.222	-2.260	.024**
	Intercept	PC	.399	.168	2.374	.018**
	Slope	PC	-.029	.219	-.132	.895
	Intercept	AR	.534	.202	2.647	.008**
	Slope	AR	-.558	.266	-2.095	.036**
	Intercept	MK	.239	.193	1.240	.215
	Slope	MK	.314	.253	1.241	.214
	Intercept	GPA	1.997	.172	11.620	< .001
	Slope	GPA	.043	.227	.191	.849
18N	Intercept	PT4	.524	.171	3.063	.002**
	Slope	PT4	-.501	.217	-2.305	.021**
	Intercept	PC	.391	.172	2.274	.023**
	Slope	PC	-.084	.215	-.393	.694
	Intercept	AR	.666	.175	3.800	< .001
	Slope	AR	-.397	.221	-1.794	.073
	Intercept	GPA	2.042	.170	11.996	< .001
	Slope	GPA	.102	.215	.472	.637
	Intercept	AGE	-.045	.184	-.243	.808
	Slope	AGE	.506	.234	2.163	.031**
18O	Intercept	PT4	.500	.172	2.911	.004**
	Slope	PT4	-.491	.216	-2.274	.023**
	Intercept	PC	.352	.174	2.030	.042**
	Slope	PC	-.076	.214	-.355	.723
	Intercept	AR	.668	.176	3.806	< .001
	Slope	AR	-.388	.219	-1.771	.076
	Intercept	GPA	2.029	.171	11.889	< .001
	Slope	GPA	.098	.213	.460	.646
	Intercept	AGE	-.306	.231	-1.325	.185

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	AGE	.560	.290	1.931	.054
	Intercept	EDUC	.433	.233	1.856	.064
	Slope	EDUC	-.085	.289	-.293	.770
18P	Intercept	PT4	.524	.171	3.066	.002**
	Slope	PT4	-.501	.218	-2.302	.021**
	Intercept	PC	.392	.172	2.282	.023**
	Slope	PC	-.083	.215	-.386	.699
	Intercept	AR	.676	.176	3.838	< .001
	Slope	AR	-.391	.222	-1.758	.079
	Intercept	GPA	2.037	.170	11.961	< .001
	Slope	GPA	.099	.216	.461	.645
	Intercept	AGE	-.037	.185	-.198	.843
	Slope	AGE	.513	.236	2.176	.030**
	Intercept	TRN_HRS	-.130	.231	-.562	.574
	Slope	TRN_HRS	-.080	.284	-.281	.779
18Q	Intercept	PT4	.533	.171	3.115	.002**
	Slope	PT4	-.499	.217	-2.299	.022**
	Intercept	PC	.397	.172	2.310	.021**
	Slope	PC	-.084	.214	-.393	.694
	Intercept	AR	.674	.175	3.846	< .001
	Slope	AR	-.394	.221	-1.784	.074
	Intercept	GPA	2.018	.171	11.805	< .001
	Slope	GPA	.101	.216	.465	.642
	Intercept	AGE	-.048	.183	-.263	.793
	Slope	AGE	.501	.234	2.144	.032**
	Intercept	BILLET	.512	.390	1.313	.189
	Slope	BILLET	.019	.483	.039	.969
18R	Intercept	PT4	.532	.171	3.107	.002**
	Slope	PT4	-.499	.218	-2.284	.022**
	Intercept	PC	.393	.172	2.291	.022**
	Slope	PC	-.084	.215	-.391	.696
	Intercept	AR	.696	.181	3.857	< .001
	Slope	AR	-.387	.228	-1.696	.090
	Intercept	GPA	2.028	.171	11.855	< .001
	Slope	GPA	.098	.217	.453	.650
	Intercept	AGE	-.040	.184	-.216	.829
	Slope	AGE	.504	.235	2.148	.032**
	Intercept	SEX	-.246	.388	-.633	.526

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	SEX	-.096	.486	-.198	.843

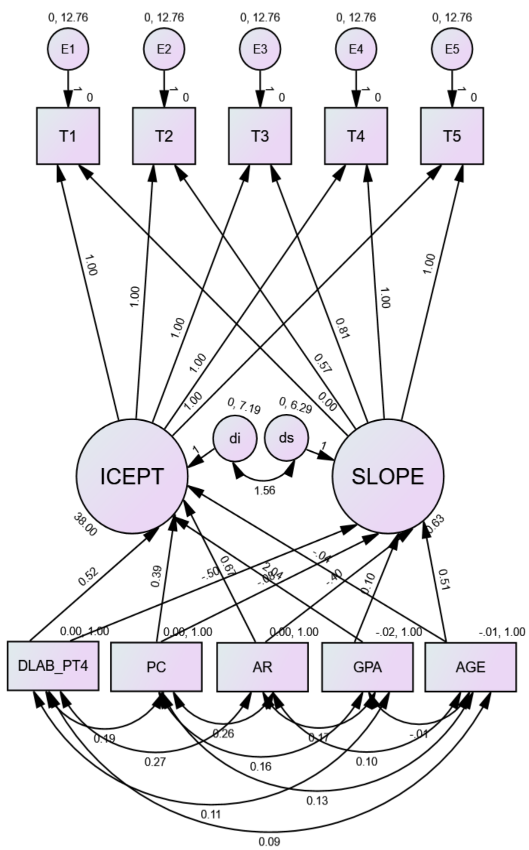
**p < .05

For the final model, 18N, (Figure 60), all residual variances were positive and significant (E1 = 12.764; SE = .454; CR = 28.130, p < .001; E2 = 12.764; SE = .454; CR = 28.130, p < .001; E3 = 12.764; SE = .454; CR = 28.130, p < .001; E4 = 12.764; SE = .454; CR = 28.130, p < .001; E5 = 12.764; SE = .454; CR = 28.130, p < .001). 18N was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 139). GPA had the largest significant regression weight on the intercept (2.042), followed by ASVAB AR (.666), DLAB PT4 (.524), and ADVAB PC (.391). These results suggest that those participants who had higher GPAs at DLI and had higher scores on the ASVAB AR, DLAB PT4, and ASVAB PC subtests were more likely to have higher DLPT reading scores at graduation. The only predictors with significant regression weights on the slope were AGE (.506) and DLAB PT4 (-.501), implying that those participants who were older when they started at DLI and those who had lower scores on the DLAB PT4 (due to the negative value of the weight) experienced slightly more growth in reading language proficiency (as measured by the DLPT) over the five test occasions. TRN_HRS, EDUC, BILLET, and SEX were not found to be significant predictors of the intercept or slope in the analysis. There was a significant covariance between several of the predictors (see Appendix).

The results from Phases II, III, and IV for the Korean Reading DLPT reading suggest that the participants' GPA had the largest positive impact on their performance on the DLPT reading at graduation with those participants with higher GPAs performing better. The participants whose performance was better on the ASVAB AR, DLAB PT4, and ASVAB PC were also more likely to perform better on the DLPT reading at graduation. The results also suggest that those participants who were older when they attended DLI and those who received lowers scores on the DLAB PT4 experienced more growth in language proficiency over the five DLPT reading test occasions.

Figure 60

Path Diagram Korean Reading: Phase IV Model 18N



Arabic Listening

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Arabic (MSA) DLPT listening was 1541 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Arabic listening sample are shown in Table 140. 70.4% of the sample had four test occasions, and 45.2% had five test occasions. Figure 61 displays the mean DLPT listening scores at each test occasion. The average listening proficiency increased from one test occasion to the next. The mean growth indicates that the participants did experience some growth. The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Arabic listening scores at all test occasions are slightly negatively or positively skewed and that the scores are slightly platykurtic or slightly leptokurtic.

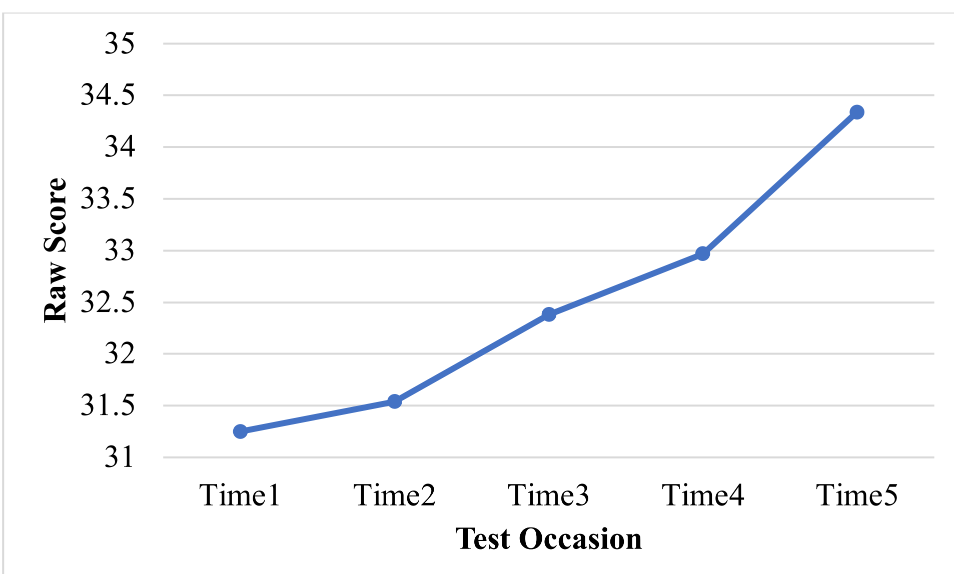
Table 140. Arabic Listening Descriptive Statistics

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
Time1	1541	31.25	.164	6.425	41.279	-.075	.062	-.172	.125
Time2	1541	31.54	.160	6.286	39.516	-.066	.062	.027	.125
Time3	1541	32.38	.162	6.363	40.481	.041	.062	-.099	.125
Time4	1085	32.97	.186	6.131	37.593	-.125	.074	-.201	.148
Time5	696	34.34	.240	6.321	39.960	-.231	.093	-.120	.185
APT*	1541	121.47	.274	10.738	115.305	.272	.062	-.043	.125
COG*	1541	92.46	.175	6.885	47.408	-1.498	.062	2.644	.125
ATT*	1112	3.82	.029	.969	.939	-.332	.073	-.241	.147

***Descriptive statistics before standardization**

Figure 61

Mean DLPT Listening Scores by Test Occasion: Arabic



Two growth models, linear and non-linear were compared. The linear model, Model 19AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 19A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 19A indicated a better model fit (χ^2= 176.549, *df* = 11, *p* = .00; CFI = .944; RMSEA = .004, CI = .003-.004) than Model 19AA (χ^2= 202.768, *df* = 14 , *p* = .00; CFI = .936; RMSEA = .004, CI = .003-.004). Therefore, Model 19A was accepted as the base model.

For Model 19A, the mean slope was positive and significant (*M* = 3.403, *p* < .001) indicating that the Arabic DLPT listening scores increased over time. The mean intercept was significant (*M* = 31.246, *p* < .001). The covariance between the slope and the intercept was positive but not significant (2.723, *p* > .05). The slope variance was positive but not significant (.885, *p* > .05). The intercept variance (23.103, *p* < .001) was significant indicating that there were significant inter-participant differences on the initial Arabic DLPT Listening score. Table 142 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the nonlinear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Language Difficulty Category IV languages (see Chapter 4). The model fit statistics for all models are listed in Table 141, the parameter statistics are listed in Table 142, and the standardized regression weights are listed in Table 143.

Table 141. Arabic Listening Model Fit Statistics

Model	*Model Variables*	χ^2	*df*	*P*	CFI	RMSEA	CI
19A	Base	176.549	11	.000	.944	.004	.003 - .004
19B	19A + APT	177.990	14	.000	.945	.003	.003 - .004
19C	19B + COG	181.059	17	.000	.949	.003	.003 - .003
19D	19C + ATT	184.196	20	.000	.949	.003	.002 - .003

Table 142. Arabic Listening Parameter Statistics

Model	*Model Variables*	Intercept (I) *M*	Slope (S) *M*	Variance (I)	Variance (S)	I/S Covariance
19A	Base	31.246*	3.403*	23.103*	.885	1.723
19B	19A + APT	31.246*	3.399*	22.125*	.847	1.668
19C	19B + COG	31.247*	3.404*	21.717*	.816	1.753
19D	19C + ATT	31.253*	3.403*	21.695*	.739	1.787

*p < .001 **p < .05

Table 143. Arabic Listening Standardized Regression Weights

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
19B	Intercept	APT	.987	.139	7.103	< .001
	Slope	APT	.052	.172	.301	.763
19C	Intercept	APT	.725	.149	4.860	< .001
	Slope	APT	.101	.186	.544	.587
	Intercept	COG	.690	.149	4.624	< .001
	Slope	COG	-.129	.186	-.695	.487
19D	Intercept	APT	.713	.150	4.767	< .001
	Slope	APT	.117	.186	.626	.531
	Intercept	COG	.695	.149	4.661	< .001
	Slope	COG	-.134	.186	-.724	.469
	Intercept	ATT	.164	.163	1.009	.313
	Slope	ATT	-.214	.201	-1.067	.286

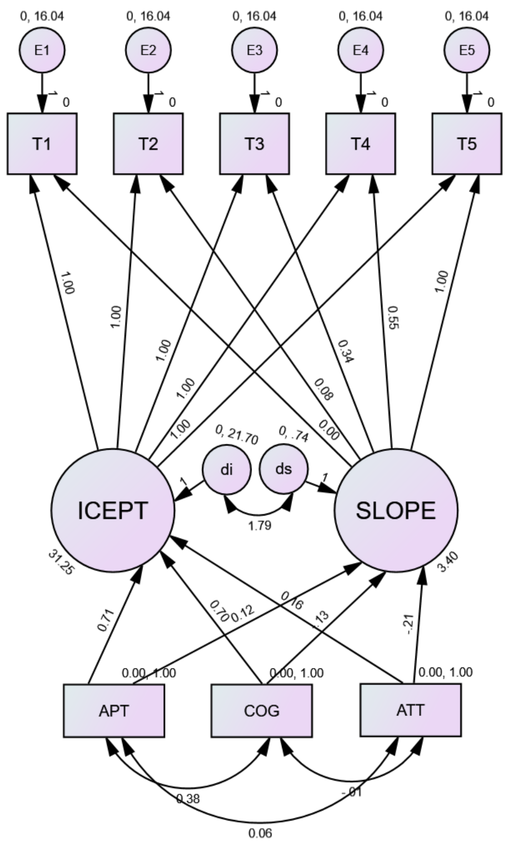
**p < .05

For the final model, Model 19D (Figure 62), the residual variances were all positive and significant (E1 = 16.039; *SE* = .365, CR = 43.984, $p < .001$; E2 = 16.039; *SE* = .365, CR = 43.984, $p < .001$; E3 = 16.039; *SE* = .365, CR = 43.984, $p < .001$; E4 = 16.039; *SE* = .365, CR = 43.984, $p < .001$; E5 = 16.039; *SE* = .365, CR = 43.984, $p < .001$). Both COG (.695) and APT

(.713) were significant predictors of the intercept; general cognitive aptitude and language aptitude predicted the initial Arabic Listening scores. The covariance between APT and COG is also significant. None of the predictors were significant predictors of the slope.

Figure 62

Path Diagram Arabic Listening: Phase II Model 19D



Phase III

The same dataset from Arabic Listening Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base nonlinear model (see Phase II) one at a time. ATT was not added to the model as it was not significant in Phase II. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 144.

Table 144. Arabic Listening Descriptive Statistics: ASVAB and DLAB Subtests

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
ASVAB_WK*	1541	63.17	.155	6.080	36.965	-.076	.062	-.263	.125
ASVAB_PC*	1541	62.48	.114	4.464	19.926	-.526	.062	-.131	.125
ASVAB_AR*	1541	63.32	.129	5.073	25.740	-.428	.062	.259	.125
ASVAB_MK*	1541	63.64	.121	4.743	22.492	-.336	.062	-.213	.125
DLAB_PT1*	1541	3.40	.039	1.550	2.404	.080	.062	-.543	.125
DLAB_PT2*	1541	13.44	.073	2.871	8.240	-.523	.062	-.249	.125
DLAB_PT3*	1541	48.39	.137	5.377	28.914	-.375	.062	3.757	.125
DLAB_PT4*	1541	20.41	.101	3.975	15.801	-.398	.062	.104	.125

Descriptive statistics before standardization

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for DLI Language Difficulty Category IV languages. When a subtest was not a significant predictor, it was excluded from the next model. The model fit statistics for all models are listed in Table 145, the parameter statistics are listed in Table 146, and the standardized regression weights are listed in Table 147.

Table 145. Arabic Listening Model Fit Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
19A	Base	176.549	11	.000	.944	.004	.003 - .004
19E	19A + PT3	178.378	14	.000	.944	.003	.003 - .004
19F	19E+ PT2	179.150	17	.000	.947	.003	.003 - .003
19G	19F + PT1	188.674	20	.000	.945	.003	.002 - .003
19H	19G + PT4	190.723	23	.000	.947	.003	.002 - .003
19I	19H – PT4 + WK	192.152	23	.000	.949	.003	.002 - .003
19J	19I + PC	196.292	26	.000	.953	.003	.002 - .003
19K	19I + AR	194.374	26	.000	.951	.003	.002 - .003
19L	19K – PT3 + MK	196.539	26	.000	.954	.003	.002 - .003
19M	19L – MK	192.221	23	.000	.947	.003	.002 - .003

Table 146. Arabic Listening Parameter Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	**Intercept (I) *M***	**Slope (S) *M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
19A	Base	31.246*	3.403*	23.103*	.885	1.723

19E	19A + PT3	31.242*	3.405*	22.582*	.885	1.769
19F	19E + PT2	31.242*	3.402*	22.255*	.886	1.744
19G	19F + PT1	31.230*	3.398*	22.001*	.835	1.597
19H	19G + PT4	31.233*	3.401*	21.934*	.775	1.585
19I	19H – PT4 + WK	31.229*	3.411*	21.476*	.764	1.739
19J	19I + PC	31.233*	3.406*	21.423*	.681	1.697
19K	19I + AR	31.234*	3.412*	21.323*	.708	1.810
19L	19K – PT3 + MK	31.238*	3.425*	21.317*	.611	1.770
19M	19L – MK	31.235*	3.412*	21.383*	.709	1.803

*p < .001 **p < .05

Table 147. Arabic Listening Standardized Regression Weights: ASVAB and DLAB Subtests

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
19E	Intercept	PT3	.721	.140	5.146	< .001
	Slope	PT3	-.063	.172	-.366	< .001
19F	Intercept	PT3	.590	.143	4.127	< .001
	Slope	PT3	-.062	.177	-.353	.724
	Intercept	PT2	.588	.143	4.117	< .001
	Slope	PT2	-.005	.177	-.029	.977
19G	Intercept	PT3	.538	.143	3.756	< .001
	Slope	PT3	-.098	.178	-.550	.582
	Intercept	PT2	.587	.143	4.119	< .001
	Slope	PT2	-.008	.177	-.045	.964
	Intercept	PT1	.504	.140	3.607	< .001
	Slope	PT1	.217	.174	1.252	.211
19H	Intercept	PT3	.474	.148	3.214	.001**
	Slope	PT3	-.135	.183	-.738	.461
	Intercept	PT2	.605	.143	4.243	< .001
	Slope	PT2	-.010	.177	-.055	.957
	Intercept	PT1	.503	.140	3.605	< .001
	Slope	PT1	.215	.173	1.240	.215
	Intercept	PT4	.257	.143	1.796	.072
	Slope	PT4	.139	.178	.782	.434
19I	Intercept	PT3	.330	.148	2.233	.026**
	Slope	PT3	-.047	.185	-.251	.801
	Intercept	PT2	.573	.141	4.057	< .001
	Slope	PT2	-.006	.177	-.033	.974
	Intercept	PT1	.390	.140	2.779	.005**
	Slope	PT1	.247	.176	1.402	.161

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Intercept	WK	.765	.146	5.243	< .001
	Slope	WK	-.192	.183	-1.048	.294
19J	Intercept	PT3	.314	.148	2.128	.033**
	Slope	PT3	-.069	.185	-.371	.711
	Intercept	PT2	.568	.141	4.025	< .001
	Slope	PT2	-.021	.177	-.122	.903
	Intercept	PT1	.393	.140	2.805	.005**
	Slope	PT1	.246	.175	1.403	.161
	Intercept	WK	.659	.160	4.132	< .001
	Slope	WK	-.308	.200	-1.542	.123
	Intercept	PC	.247	.154	1.606	.108
	Slope	PC	.291	.193	1.510	.131
19K	Intercept	PT3	.264	.149	1.775	.076
	Slope	PT3	-.016	.187	-.088	.930
	Intercept	PT2	.557	.141	3.955	< .001
	Slope	PT2	.003	.177	.019	.985
	Intercept	PT1	.388	.140	2.774	.006**
	Slope	PT1	.247	.176	1.402	.161
	Intercept	WK	.688	.148	4.655	< .001
	Slope	WK	-.159	.186	-.857	.392
	Intercept	AR	.414	.143	2.883	.004**
	Slope	AR	-.194	.181	-1.073	.283
19L	Intercept	PT2	.603	.138	4.371	< .001
	Slope	PT2	-.011	.174	-.063	.950
	Intercept	PT1	.405	.140	2.900	.004**
	Slope	PT1	.247	.176	1.408	.159
	Intercept	WK	.743	.144	5.174	< .001
	Slope	WK	-.170	.181	-.942	.346
	Intercept	AR	.291	.167	1.743	.081
	Slope	AR	-.344	.210	-1.633	.102
	Intercept	MK	.299	.164	1.826	.068
	Slope	MK	.263	.207	1.273	.203
19M	Intercept	PT2	.607	.138	4.393	< .001
	Slope	PT2	.000	.174	.003	.998
	Intercept	PT1	.402	.140	2.875	.004**
	Slope	PT1	.246	.176	1.401	.161
	Intercept	WK	.750	.144	5.212	< .001
	Slope	WK	-.162	.181	-.895	.371

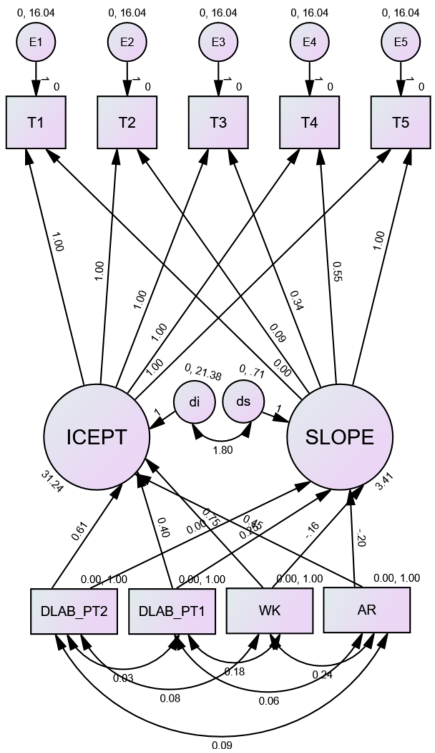
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Intercept	AR	.452	.142	3.187	.001**
	Slope	AR	-.196	.178	-1.101	.271

**p < .05

For the final model, 19M, (Figure 63), all residual variances were positive and significant (E1 = 16.041; SE = .365; CR = 43.991, p < .001; E2 = 16.041; SE = .365; CR = 43.991, p < .001; E3 = 16.041; SE = .365; CR = 43.991, p < .001; E4 = 16.041; SE = .365; CR = 43.991, p < .001; E5 = 16.041; SE = .365; CR = 43.991, p < .001). 19M was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (See Table 147). ASVAB WK had the largest regression weight value for the intercept (.750), followed by DLAB PT2 (.607), ASVAB AR (.452), and DLAB PT1 (.402). These results suggest that those participants who had higher scores on these subtests were more likely to have higher DLPT listening scores at graduation. None of the subtests had a significant predictive value for the slope.

Figure 63

Path Diagram Arabic Listening: Phase III Model 19M



Phase IV

The same dataset from Arabic Listening Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 19M (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 148.

Table 148. Arabic Listening Descriptive Statistics: Other predictors

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
GPA*	1429	3.39	.008	.320	.102	-.459	.065	.098	.129
AGE*	1110	22.31	.103	3.424	11.724	1.067	.073	1.586	.147
EDUC*	1112	4.39	.063	2.086	4.353	.247	.073	-1.458	.147

TRN_HRS*	823	372.24	7.970	228.637	52274.772	1.388	.085	2.991	.170
BILLET	1095	.48	.015	.500	.250	.075	.074	-1.998	.148
SEX	1541	.71	.012	.454	.206	-.930	.062	-1.137	.125

Descriptive statistics before standardization

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The model fit statistics for all models are listed in Table 149, the parameter statistics are listed in Table 150, and the standardized regression weights are listed in Table 151.

Table 149. Arabic Listening Model Fit Statistics: Other Predictors

Model	***Model Variables***	χ^2	***Df***	***P***	**CFI**	**RMSEA**	**CI**
19M	19L – MK	192.221	23	.000	.947	.003	.002 - .003
19N	19M + GPA	196.216	26	.000	.957	.003	.002 - .003
19O	19N – PT2, PT1, AR + AGE	190.742	20	.000	.957	.003	.003 - .003
19P	19O – AGE + EDUC	184.713	20	.000	.958	.003	.002 - .003
19Q	19P – EDUC + TRN_HRS	193.329	20	.000	.954	.003	.003 - .003
19R	19Q + BILLET	194.359	23	.000	.955	.003	.002 - .003
19S	19Q + SEX	200.331	23	.000	.954	.003	.002 - .003

Table 150. Arabic Listening Parameter Statistics: Other Predictors

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope (S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
19M	19L – MK	31.235*	3.412*	21.383*	.709	1.803
19N	19M + GPA	31.301*	3.387*	11.841*	.690	1.090
19O	19N – PT2, PT1, AR + AGE	31.309*	3.381*	11.923*	.781	1.025
19P	19O – AGE + EDUC	31.310*	3.384*	11.944*	.760	1.020
19Q	19P – EDUC + TRN_HRS	32.266*	3.315*	11.691*	.249	1.435
19R	19Q + BILLET	31.615*	3.540*	11.552*	.193	1.335
19S	19Q + SEX	30.520*	2.926*	11.461*	.097	1.339

*p < .001 **p < .05

Table 151. Arabic Listening Standardized Regression Weights: Other Predictors

Model		**Variable of Interest**	**Estimate**	***SE***	***C.R.***	***P***
19N	Intercept	PT2	.145	.116	1.252	.211
	Slope	PT2	-.058	.174	-.334	.738
	Intercept	PT1	-.117	.118	-.993	.321

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	PT1	.185	.177	1.046	.295
	Intercept	WK	.431	.120	3.589	< .001
	Slope	WK	-.187	.180	-1.036	.300
	Intercept	AR	.125	.118	1.058	.290
	Slope	AR	-.199	.178	-1.117	.264
	Intercept	GPA	3.233	.121	26.749	< .001
	Slope	GPA	.316	.184	1.717	.086
19O	Intercept	WK	.500	.131	3.816	< .001
	Slope	WK	-.178	.196	-.909	.363
	Intercept	GPA	3.239	.117	27.567	< .001
	Slope	GPA	.333	.179	1.865	.062
	Intercept	AGE	-.149	.147	-1.008	.313
	Slope	AGE	-.060	.219	-.276	.783
19P	Intercept	WK	.454	.128	3.534	< .001
	Slope	WK	-.158	.192	-.823	.411
	Intercept	GPA	3.246	.117	27.667	< .001
	Slope	GPA	.338	.178	1.894	.058
	Intercept	EDUC	-.040	.146	-.273	.785
	Slope	EDUC	-.118	.216	-.545	.586
19Q	Intercept	WK	.437	.116	3.758	< .001
	Slope	WK	-.168	.171	-.983	.326
	Intercept	GPA	3.250	.118	27.566	< .001
	Slope	GPA	.307	.175	1.753	.080
	Intercept	TRN_HRS	-.506	.155	-3.264	.001**
	Slope	TRN_HRS	.931	.214	4.354	< .001
19R	Intercept	WK	.448	.116	3.862	< .001
	Slope	WK	-.175	.171	-1.027	.304
	Intercept	GPA	3.232	.118	27.438	< .001
	Slope	GPA	.304	.175	1.733	.083
	Intercept	TRN_HRS	-.480	.156	-3.082	.002**
	Slope	TRN_HRS	.954	.215	4.440	< .001
	Intercept	BILLET	-.738	.271	-2.718	.007**
	Slope	BILLET	-.464	.385	-1.205	.228
19S	Intercept	WK	.399	.116	3.444	< .001
	Slope	WK	-.177	.170	-1.039	.299
	Intercept	GPA	3.273	.117	27.921	< .001
	Slope	GPA	.321	.175	1.835	.066
	Intercept	TRN_HRS	-.464	.155	-2.996	.003**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
	Slope	TRN_HRS	.971	.213	4.548	< .001
	Intercept	SEX	1.054	.254	4.143	< .001
	Slope	SEX	.543	.373	1.456	.145

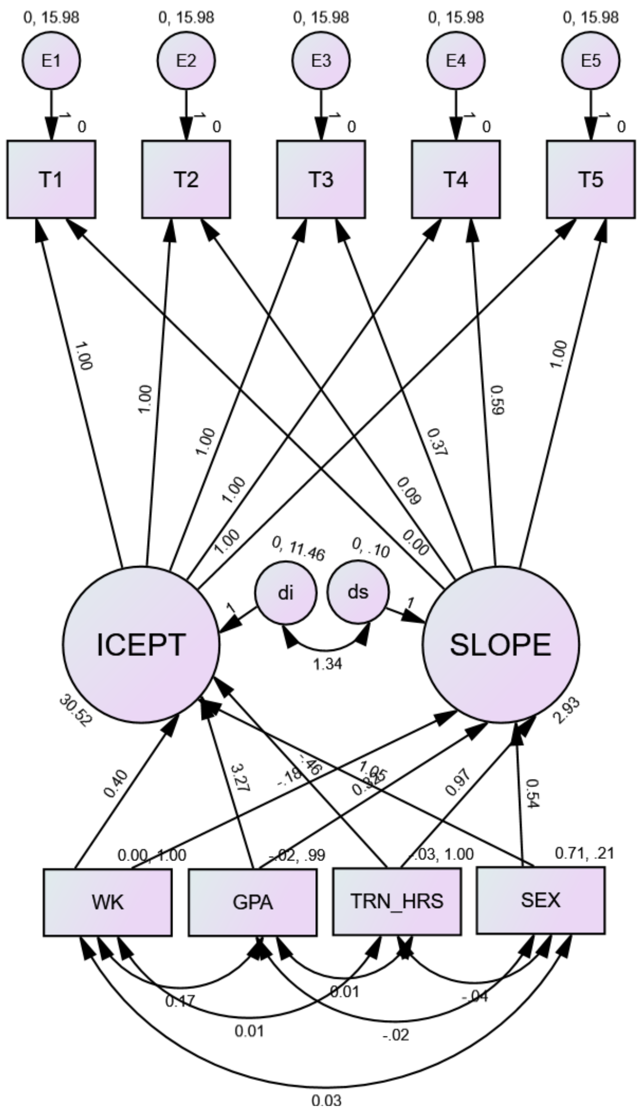
**p < .05

For the final model, 19S, (Figure 64), all residual variances were positive and significant (E1 = 15.981; SE = .365; CR = 43.793, p < .001; E2 = 15.981; SE = .365; CR = 43.793, p < .001; E3 = 15.981; SE = .365; CR = 43.793, p < .001; E4 = 15.981; SE = .365; CR = 43.793, p < .001; E5 = 15.981; SE = .365; CR = 43.793, p < .001). 19S was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 151). GPA had the largest significant regression weight on the intercept (3.373), followed by SEX (1.054), and ASVAB WK (.399). TRN_HRS did have a significant regression weight on the intercept; however, participants do not attend DOD language training hours until after their time at DLI, so this result was not interpretable. These results suggest that those participants who had higher GPAs at DLI, those who are male, and those who had higher scores on the ASVAB WK subtest were more likely to have higher DLPT listening scores at graduation. TRN_HRS was the only predictor that had a significant predictive value for the slope (.971). This result suggests that those participants who attended more DOD language training hours were more likely to experience growth in listening language proficiency (as measured by the DLPT) over the five test occasions. AGE, EDUC, and BILLET were not found to be significant predictors of the intercept or slope in the analysis. There was a significant covariance between several of the predictors (see Appendix).

The results from Phases II, III, and IV for the Arabic DLPT listening suggest that the participants' GPA had the largest positive impact on their performance on the DLPT listening at graduation. The participants who were male and whose performance on the ASVAB WK was better were more likely to perform better on the DLPT listening at graduation. The results also suggest that those participants who attended more DOD language training hours were most likely to experience growth in listening language proficiency over the five test occasions.

Figure 64

Path Diagram Arabic Listening: Phase IV Model 19S



Arabic Reading

Phase II

After data cleaning, removing outliers, and excluding records with fewer than three repeated measures, the sample for Arabic DLPT reading was 1738 records. Raw scores were used for the individual language analyses. The descriptive statistics for the Arabic reading sample are shown in Table 152. 72.3% of the sample had four test occasions, and 46.1% had five test occasions. Figure 65 displays the mean DLPT reading scores at each test occasion. The average listening proficiency decreased between Time1 and Time2 but then increased from one test occasion to the next. The *SDs* and variances indicate that there are between participant differences in scores. The skew and kurtosis values show that the distributions of Arabic reading scores at all test occasions are slightly negatively skewed and that the scores are slightly leptokurtic.

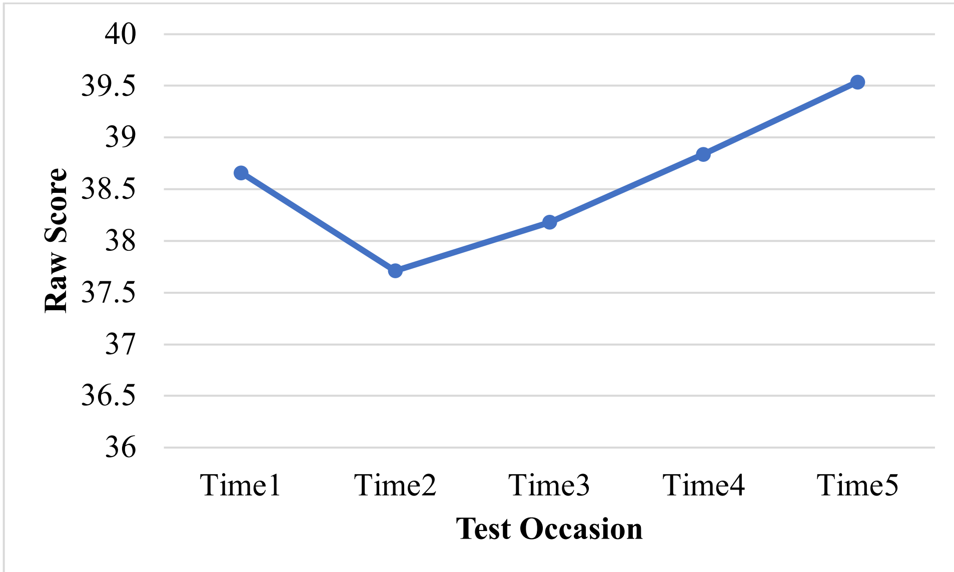
Table 152. Arabic Reading Descriptive Statistics

	N	***M***	***SE***	***SD***	**VARIANCE**	**SKEW**	***SE***	**KURTOSIS**	***SE***
Time1	1738	38.66	.121	5.050	25.507	-.499	.059	1.022	.117
Time2	1738	37.71	.138	5.738	32.929	-.490	.059	.283	.117
Time3	1738	38.18	.143	5.965	35.579	-.702	.059	1.102	.117
Time4	1285	38.84	.163	5.826	33.947	-.608	.068	.600	.136
Time5	813	39.54	.188	5.354	28.665	-.405	.086	.203	.171
APT*	1738	121.45	.258	10.756	115.701	.258	.059	-.057	.117
COG*	1738	92.36	.169	7.050	49.700	-1.562	.059	3.094	.117
ATT*	1240	3.79	.028	.970	.941	-.283	.069	-.285	.139

***Descriptive statistics before standardization**

Figure 65

Mean DLPT Reading Scores by Test Occasion: Arabic



Two growth models, linear and non-linear were compared. The linear model, Model 20AA assumed a pattern of change over time with fixed values for the slope parameters (Time1 at 0, Time2 at .25, Time3 at .50, Time4 at .75, Time5 at 1). The nonlinear model, Model 20A, fixed the slope parameter at 0 for Time1 and set the last parameter, Time5, to 1. The rest of the factor loadings were freely estimated from the data. Model 20AA indicated a better model fit (χ^2= 242.333, *df* = 14, *p* = .00; CFI = .916; RMSEA = .004, CI = .004-.004) than Model 20A (χ^2= 237.941, *df* = 14 , *p* = .00; CFI = .913; RMSEA = .005, CI = .004-.005). Therefore, Model 20AA was accepted as the base model.

For Model 20AA, the mean slope was positive and significant (*M* = .784, *p* < .001) indicating that the Arabic DLPT reading scores increased very slightly (given the small value) over time. The mean intercept was significant (*M* = 38.090, *p* < .001). The covariance between the slope and the intercept was significant (6.140, *p* < .001) implying that those participants who had higher DLPT scores at graduation experienced more growth over the five test occasions. The slope variance was not significant (.947, $p > .05$), indicating that there were not significant inter-participant differences in terms of growth on Arabic DLPT Reading over the five test occasions. The intercept variance (12.633, $p < .001$) was significant indicating that there were significant inter-participant differences on the initial Arabic DLPT Reading score. Table 154 provides a summary of the parameter statistics.

The predictor variables of interest were then added to the linear base model one a time in the following order: language aptitude (APT), general cognitive ability (COG), and attitude towards language learning (ATT), just as they were in the previous analysis of all DLI Language Difficulty Category IV languages (see Chapter 4). The model fit statistics for all models are listed in Table 153, the parameter statistics are listed in Table 154, and the standardized regression weights are listed in Table 155.

Table 153. Arabic Reading Model Fit Statistics

Model	***Model Variables***	χ^2	***df***	***p***	**CFI**	**RMSEA**	**CI**
20AA	Base	242.333	14	.000	.916	.004	.004 - .004
20B	20AA + APT	242.811	17	.000	.921	.004	.003 - .004
20C	20B + COG	244.125	20	.000	.930	.003	.003 - .004
20D	20C + ATT	247.833	23	.000	.930	.003	.003 - .003

Table 154. Arabic Reading Parameter Statistics

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope (S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
20AA	Base	38.090*	.784*	12.633*	.947	6.140*
20B	20AA + APT	38.090*	.784*	10.988*	.930	6.112*
20C	20B + COG	38.090*	.785*	10.087*	.930	6.221*
20D	20C + ATT	38.089*	.784*	10.063*	.922	6.218*

*p < .001 **p < .05

Table 155. Arabic Reading Standardized Regression Weights

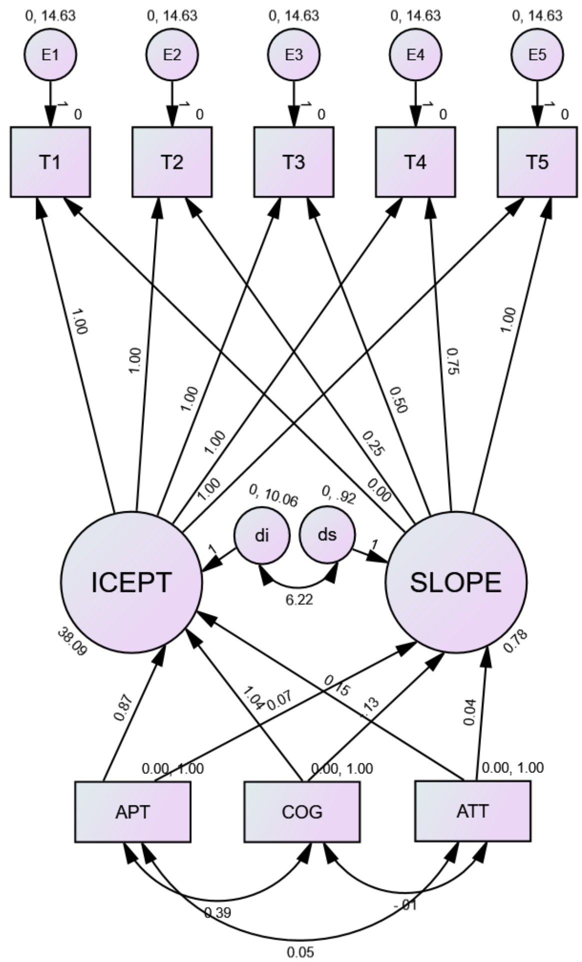
Model		Variable of Interest	Estimate	*SE*	*C.R.*	*P*
20B	Intercept	APT	1.283	.108	11.851	< .001
	Slope	APT	.019	.146	.132	.895
20C	Intercept	APT	.884	.115	7.693	< .001
	Slope	APT	.069	.158	.437	.662
	Intercept	COG	1.031	.115	8.977	< .001
	Slope	COG	-.131	.158	-.826	.409
20D	Intercept	APT	.874	.115	7.588	< .001
	Slope	APT	.066	.158	.418	.676
	Intercept	COG	1.036	.115	9.021	< .001
	Slope	COG	-.129	.158	-.817	.414
	Intercept	ATT	.154	.125	1.229	.219
	Slope	ATT	.038	.172	.221	.825

**$p < .05$

For the final model, Model 20D (Figure 66), the residual variances were all positive and significant (E1 = 14.630; *SE* = .319, CR = 45.808, $p < .001$; E2 = 14.630; *SE* = .319, CR = 45.808, $p < .001$; E3 = 14.630; *SE* = .319, CR = 45.808, $p < .001$; E4 = 14.630; *SE* = .319, CR = 45.808, $p < .001$; E5 = 14.630; *SE* = .319, CR = 45.808, $p < .001$). APT and COG were significant predictors of the intercept; general cognitive ability and language aptitude predicted the initial Arabic reading scores. COG was a stronger predictor (1.036) than APT (.874), which goes against the prediction based on the literature that APT would be a stronger predictor of DLI Language Difficulty Category IV languages. None of the predictors were significant predictors of the slope.

Figure 66

Path Diagram Arabic Reading: Phase II Model 20D



Phase III

The same dataset from Arabic Reading Phase II was used for Phase III. Subtests from the ASVAB and DLAB were entered into the base linear model (see Phase II) one at a time. The descriptive statistics for the ASVAB and DLAB subtests (before standardization) are in Table 156.

Table 156. Arabic Reading Descriptive Statistics: ASVAB and DLAB Subtests

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
ASVAB_WK*	1738	63.03	.147	6.147	37.781	-.080	.059	-.254	.117
ASVAB_PC*	1738	62.50	.107	4.481	20.080	-.519	.059	-.180	.117

ASVAB_AR*	1738	63.32	.121	5.062	25.623	-.379	.059	.175	.117
ASVAB_MK*	1738	63.68	.114	4.740	22.467	-.310	.059	-.238	.117
DLAB_PT1*	1738	3.40	.037	1.552	2.407	.085	.059	-.550	.117
DLAB_PT2*	1738	13.43	.069	2.877	8.278	-.529	.059	-.217	.117
DLAB_PT3*	1738	48.36	.130	5.412	29.287	-.352	.059	3.201	.117
DLAB_PT4*	1738	20.44	.094	3.921	15.374	-.393	.059	.106	.117

Descriptive statistics before standardization

DLAB subtests were entered into the model first because existing literature suggests that language aptitude, as measured by the DLAB, has more of an impact on language proficiency than general cognitive ability, as measured by the ASVAB, for DLI Difficulty Category IV languages. The subtests were entered in the same order as they were for the Arabic listening analysis. When a subtest was not a significant predictor, it was excluded from the next model. The model fit statistics for all models are listed in Table 157, the parameter statistics are listed in Table 158, and the standardized regression weights are listed in Table 159.

Table 157. Arabic Reading Model Fit Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	χ^2	***df***	***P***	**CFI**	**RMSEA**	**CI**
20AA	Base	242.333	14	.000	.916	.004	.004 - .004
20E	20AA + PT3	243.594	17	.000	.919	.004	.003 - .004
20F	20E + PT2	247.006	20	.000	.922	.003	.003 - .004
20G	20E + PT1	250.990	20	.000	.919	.003	.003 - .004
20H	20G + PT4	252.091	23	.000	.923	.003	.003 - .003
20I	20H + WK	255.520	26	.000	.931	.003	.003 - .003
20J	20I + PC	255.944	29	.000	.940	.003	.002 - .003
20K	20J + AR	258.384	32	.000	.945	.003	.002 - .003
20L	20K – PT4 + MK	260.446	32	.000	.949	.003	.002 - .003

Table 158. Arabic Reading Parameter Statistics: ASVAB and DLAB Subtests

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope (S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
20AA	Base	38.090*	.784*	12.633*	.947	6.140*
20E	20AA + PT3	38.090*	.785*	11.477*	.934	6.035*
20F	20E + PT2	38.090*	.785*	11.439*	.932	6.032*
20G	20E + PT1	38.091*	.781*	11.249*	.855	5.977*
20H	20G + PT4	38.090*	.782*	11.002*	.808	6.064*

20I	20H + WK	38.090*	.781*	10.383*	.814	6.076*
20J	20I + PC	38.090*	.782*	10.231*	.809	6.068*
20K	20J + AR	38.090*	.782*	10.009*	.793	6.156*
20L	20K – PT4 + MK	38.089*	.787*	9.918*	.788	6.077*

*p < .001 **p < .05

Table 159. Arabic Reading Standardized Regression Weights: ASVAB and DLAB Subtests

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
20E	Intercept	PT3	1.076	.110	9.824	< .001
	Slope	PT3	.094	.146	.647	.517
20F	Intercept	PT3	1.033	.112	9.211	< .001
	Slope	PT3	.093	.149	.621	.535
	Intercept	PT2	.201	.112	1.791	.073
	Slope	PT2	.007	.149	.048	.962
20G	Intercept	PT3	1.031	.110	9.412	< .001
	Slope	PT3	.078	.146	.533	.594
	Intercept	PT1	.478	.110	4.368	< .001
	Slope	PT1	.120	.146	.822	.411
20H	Intercept	PT3	.909	.112	8.117	< .001
	Slope	PT3	.120	.150	.798	.425
	Intercept	PT1	.471	.109	4.326	< .001
	Slope	PT1	.122	.146	.836	.403
	Intercept	PT4	.509	.112	4.560	< .001
	Slope	PT4	-.164	.150	-1.096	.273
20I	Intercept	PT3	.703	.114	6.174	< .001
	Slope	PT3	.124	.155	.799	.424
	Intercept	PT1	.362	.108	3.347	< .001
	Slope	PT1	.124	.148	.844	.399
	Intercept	PT4	.330	.113	2.934	.003**
	Slope	PT4	-.160	.153	-1.041	.298
	Intercept	WK	.854	.116	7.379	< .001
	Slope	WK	-.017	.158	-.106	.916
20J	Intercept	PT3	.679	.114	5.982	< .001
	Slope	PT3	.123	.155	.793	.428
	Intercept	PT1	.360	.108	3.336	< .001
	Slope	PT1	.124	.147	.840	.401
	Intercept	PT4	.269	.113	2.375	.018**
	Slope	PT4	-.162	.155	-1.042	.297
	Intercept	WK	.676	.125	5.403	< .001

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	WK	-.023	.171	-.132	.895
	Intercept	PC	.445	.121	3.676	< .001
	Slope	PC	.015	.166	.093	.926
20K	Intercept	PT3	.619	.114	5.445	< .001
	Slope	PT3	.146	.156	.934	.350
	Intercept	PT1	.354	.107	3.300	< .001
	Slope	PT1	.125	.147	.849	.396
	Intercept	PT4	.158	.115	1.371	.170
	Slope	PT4	-.110	.159	-.692	.489
	Intercept	WK	.647	.125	5.193	< .001
	Slope	WK	-.014	.171	-.080	.937
	Intercept	PC	.333	.123	2.709	.007**
	Slope	PC	.062	.169	.365	.715
	Intercept	AR	.522	.116	4.488	< .001
	Slope	AR	-.221	.160	-1.382	.167
20L	Intercept	PT3	.611	.113	5.419	< .001
	Slope	PT3	.112	.156	.718	.473
	Intercept	PT1	.358	.107	3.350	< .001
	Slope	PT1	.131	.147	.890	.373
	Intercept	WK	.666	.123	5.403	< .001
	Slope	WK	-.029	.170	-.172	.864
	Intercept	PC	.343	.122	2.812	.005**
	Slope	PC	.050	.168	.294	.769
	Intercept	AR	.344	.131	2.623	.009**
	Slope	AR	-.352	.181	-1.948	.051
	Intercept	MK	.407	.126	3.229	.001**
	Slope	MK	.197	.174	1.136	.256

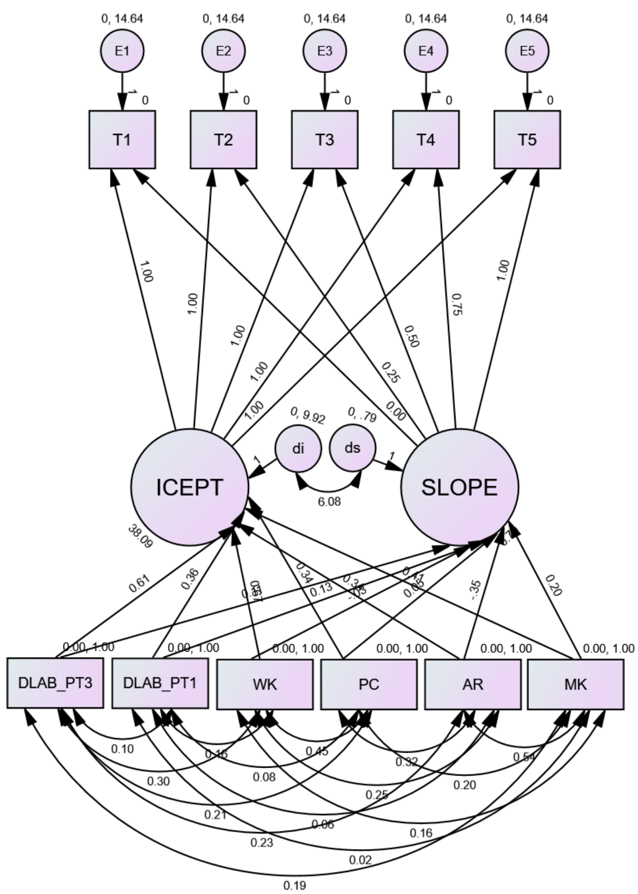
**p < .05

For the final model, 20L, (Figure 67), all residual variances were positive and significant (E1 = 14.636; SE = .319; CR = 45.816, p < .001; E2 = 14.636; SE = .319; CR = 45.816, p < .001; E3 = 14.636; SE = .319; CR = 45.816, p < .001; E4 = 14.636; SE = .319; CR = 45.816, p < .001; E5 = 14.636; SE = .319; CR = 45.816, p < .001). 20L was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 159). ASVAB WK had the largest regression weight value for the intercept (.666), followed by DLAB

PT3 (.611), ASVAB MK (.407), DLAB PT1 (.358), ASVAB AR (.344), and ASVAB PC (.343). These results suggest that those participants who had higher scores on these subtests were more likely to have higher DLPT reading scores at graduation. None of the predictors had significant predictive values for the slope.

Figure 67

Path Diagram Arabic Reading: Phase III Model 20L



Phase IV

The same dataset from Arabic Reading Phases II and III was used for Phase IV. Other individual difference predictors were entered into the nonlinear model 20L (see Phase III) one at a time. The predictors were entered into the model in the following order: GPA, AGE, EDUC (education level), TRN_HRS (training hours), BILLET, and SEX. BILLET and SEX were not standardized since they are categorical variables with two levels (see Chapter 3). The descriptive statistics for the predictors (before standardization) are in Table 160.

Table 160. Arabic Reading Descriptive Statistics: Other predictors

	N	*M*	*SE*	*SD*	VARIANCE	SKEW	*SE*	KURTOSIS	*SE*
GPA*	1611	3.38	.008	.330	.109	-.577	.061	.860	.122
AGE*	1238	22.32	.098	3.458	11.959	1.056	.070	1.440	.139
EDUC*	1240	4.40	.059	2.088	4.358	.242	.069	-1.469	.139
TRN_HRS*	1496	372.53	7.560	228.187	52069.412	1.352	.081	2.804	.162
BILLET	1213	.48	.014	.500	.250	.084	.070	-1.996	.140
SEX	1738	.71	.011	.453	.205	-.942	.059	-1.114	.117

Descriptive statistics before standardization

When a predictor was not a significant predictor of the intercept or slope, it was excluded from the next model. The model fit statistics for all models are listed in Table 161, the parameter statistics are listed in Table 162, and the standardized regression weights are listed in Table 163.

Table 161. Arabic Reading Model Fit Statistics: Other Predictors

Model	***Model Variables***	χ^2	***Df***	***p***	**CFI**	**RMSEA**	**CI**
20L	20K – PT4 + MK	260.446	32	.000	.949	.003	.002 - .003
20M	20L + GPA	266.362	35	.000	.957	.003	.002 - .003
20N	20M – PT3, PT1 + AGE	267.180	32	.000	.955	.003	.002 - .003
20O	20N – AGE + EDUC	270.492	32	.000	.954	.003	.002 - .003
20P	20N – EDUC + TRN_HRS	262.855	32	.000	.954	.003	.002 - .003
20Q	20P + BILLET	270.381	35	.000	.953	.003	.002 - .003
20R	20P + SEX	267.257	35	.000	.955	.002	.001 - .002

Table 162. Arabic Reading Parameter Statistics: Other Predictors

Model	***Model Variables***	**Intercept (I)** ***M***	**Slope(S)** ***M***	**Variance (I)**	**Variance (S)**	**I/S Covariance**
20L	20K – PT4 + MK	38.089*	.787*	9.918*	.788	6.077*
20M	20L + GPA	38.172*	.828*	3.845*	.328	4.839*
20N	20M – PT3, PT1 + AGE	38.166*	.828*	3.869*	.347	4.857*
20O	20N – AGE + EDUC	38.166*	.827*	3.868*	.352	4.842*
20P	20N – EDUC + TRN_HRS	38.173*	.813*	3.878*	.150	4.782*
20Q	20P + BILLET	38.070*	1.029*	3.868*	.250	4.801*

20R	20P + SEX	38.148*	.528	3.884*	.056	4.779*

*p < .001 **p < .05

Table 163. Arabic Reading Standardized Regression Weights: Other Predictors

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
20M	Intercept	PT3	.123	.096	1.278	.201
	Slope	PT3	.032	.157	.206	.837
	Intercept	PT1	-.032	.091	-.349	.727
	Slope	PT1	.052	.148	.349	.727
	Intercept	WK	.536	.103	5.189	< .001
	Slope	WK	-.076	.169	-.451	.652
	Intercept	PC	.319	.102	3.118	.002**
	Slope	PC	.070	.167	.420	.675
	Intercept	AR	.268	.110	2.437	.015**
	Slope	AR	-.367	.180	-2.046	.041**
	Intercept	MK	.215	.106	2.032	.042**
	Slope	MK	.165	.173	.955	.340
	Intercept	GPA	2.576	.093	27.658	< .001
	Slope	GPA	.503	.154	3.266	.001**
20N	Intercept	WK	.591	.109	5.411	< .001
	Slope	WK	-.102	.178	-.575	.565
	Intercept	PC	.333	.103	3.249	.001**
	Slope	PC	.068	.167	.406	.685
	Intercept	AR	.290	.111	2.601	.009**
	Slope	AR	-.383	.182	-2.107	.035**
	Intercept	MK	.217	.106	2.041	.041**
	Slope	MK	.177	.174	1.021	.307
	Intercept	GPA	2.587	.091	28.472	< .001
	Slope	GPA	.522	.150	3.473	< .001
	Intercept	AGE	-.099	.117	-.847	.397
	Slope	AGE	.109	.189	.573	.567
20O	Intercept	WK	.518	.108	4.813	< .001
	Slope	WK	-.068	.175	-.387	.699
	Intercept	PC	.317	.103	3.090	.002**
	Slope	PC	.073	.167	.433	.665
	Intercept	AR	.263	.110	2.385	.017**
	Slope	AR	-.366	.180	-2.035	.042**
	Intercept	MK	.232	.106	2.193	.028**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	MK	.167	.173	.968	.333
	Intercept	GPA	2.592	.091	28.610	< .001
	Slope	GPA	.517	.150	3.453	< .001
	Intercept	EDUC	.116	.114	1.014	.311
	Slope	EDUC	.017	.185	.092	.926
20P	Intercept	WK	.552	.101	5.480	< .001
	Slope	WK	-.063	.164	-.384	.701
	Intercept	PC	.320	.103	3.120	.002**
	Slope	PC	.044	.167	.263	.793
	Intercept	AR	.281	.110	2.553	.011**
	Slope	AR	-.307	.180	-1.708	.088
	Intercept	MK	.225	.106	2.128	.033**
	Slope	MK	.166	.172	.962	.336
	Intercept	GPA	2.593	.091	28.621	< .001
	Slope	GPA	.513	.150	3.430	< .001
	Intercept	TRN_HRS	.085	.121	.706	.480
	Slope	TRN_HRS	.568	.187	3.041	.002**
20Q	Intercept	WK	.549	.101	5.448	< .001
	Slope	WK	-.060	.164	-.368	.713
	Intercept	PC	.317	.102	3.091	.002**
	Slope	PC	.052	.167	.311	.756
	Intercept	AR	.286	.110	2.593	.010**
	Slope	AR	-.317	.180	-1.764	.078
	Intercept	MK	.227	.106	2.149	.032**
	Slope	MK	.162	.172	.939	.347
	Intercept	GPA	2.595	.091	28.640	< .001
	Slope	GPA	.509	.150	3.407	< .001
	Intercept	TRN_HRS	.075	.121	.616	.538
	Slope	TRN_HRS	.602	.187	3.216	.001**
	Intercept	BILLET	.218	.212	1.028	.304
	Slope	BILLET	-.443	.335	-1.322	.186
20R	Intercept	WK	.551	.101	5.464	< .001
	Slope	WK	-.069	.164	-.421	.673
	Intercept	PC	.319	.103	3.110	.002**
	Slope	PC	.038	.167	.228	.820
	Intercept	AR	.276	.112	2.466	.014**
	Slope	AR	-.345	.182	-1.894	.058
	Intercept	MK	.225	.106	2.129	.033**

Model		Variable of Interest	Estimate	*SE*	*C.R.*	*p*
	Slope	MK	.172	.172	.999	.318
	Intercept	GPA	2.593	.091	28.506	< .001
	Slope	GPA	.530	.150	3.535	< .001
	Intercept	TRN_HRS	.083	.121	.684	.494
	Slope	TRN_HRS	.605	.187	3.239	.001**
	Intercept	SEX	.036	.203	.179	.858
	Slope	SEX	.409	.330	1.240	.215

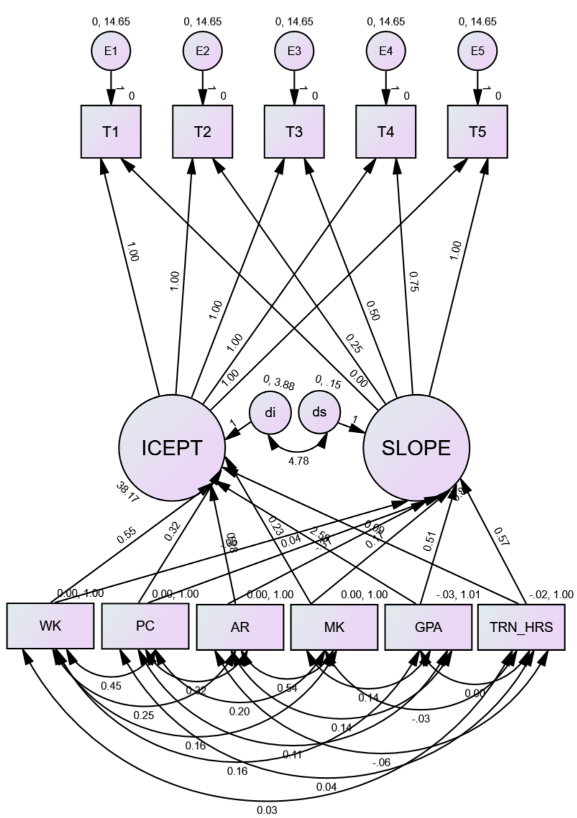
**p < .05

For the final model, 20P, (Figure 68), all residual variances were positive and significant (E1 = 14.652; SE = .320; CR = 45.857, p < .001; E2 = 14.652; SE = .320; CR = 45.857, p < .001; E3 = 14.652; SE = .320; CR = 45.857, p < .001; E4 = 14.652; SE = .320; CR = 45.857, p < .001; E5 = 14.652; SE = .320; CR = 45.857, p < .001). 20P was accepted as the final model because all predictors were found to be significant predictors of the intercept or slope (see Table 163). GPA had the largest significant regression weight on the intercept (2.593), followed by ASVAB WK (.552), ASVAB PC (.320), ASVAB AR (.281), and ASVAB MK (.225). These results suggest that those participants who had higher GPAs at DLI and had higher scores on the ASVAB WK, ASVAB PC, ASVAB AR, and ASVAB MK subtests were more likely to have higher DLPT reading scores at graduation. The only predictors with significant regression weights on the slope were TRN_HRS (.568) and GPA (.513), implying that those participants who completed more DOD language training hours and who had higher GPAs at DLI experienced more growth in reading language proficiency (as measured by the DLPT) over the five test occasions. AGE, EDUC, BILLET, and SEX were not found to be significant predictors of the intercept or slope in the analysis. There was a significant covariance between several of the predictors (see Appendix).

The results from Phases II, III, and IV for the Reading DLPT reading suggest that the participants' GPA had the largest positive impact on their performance on the DLPT reading at graduation with those participants with higher GPAs performing better. The participants whose performance was better on the ASVAB WK, ASVAB PC, ASVAB AR, and ASVAB MK were also more likely to perform better on the DLPT reading at graduation. The results also suggest that those participants who completed more DOD language training hours and those who had higher GPAs while attending DLI experienced more growth in language proficiency over the five DLPT reading test occasions.

Figure 68

Path Diagram Arabic Reading: Phase IV Model 20P



Chapter 6: Discussion

This study used latent growth curve modeling to investigate the impact of individual difference factors on language proficiency outcomes. The three main predictors were general cognitive ability (as measured by the ASVAB), language aptitude (as measured by the DLAB), and attitude towards learning the assigned L2 (measured by the DLIFLC motivation survey item), and the language proficiency outcomes were participants' DLPT reading and listening scores. The current study also investigated the influence of additional factors on language proficiency outcomes: language difficulty category, GPA, age, educational level, number of language training hours, billet type, and sex. The analyses were conducted in four phases. Phase I involved running latent growth prediction models using converted ILR scores for the entire DLPT Listening and DLPT Reading datasets without predictors (for results see Chapter 4). Phase I also included running latent growth prediction models using converted ILR scores for the DLPT Listening and DLPT Reading datasets for DLI Language Difficulty Categories I, III, and IV languages with the three main predictors: cognitive aptitude (COG), language aptitude (APT), and attitude towards language learning (ATT) (for results see Chapter 4). Phase II involved running latent growth prediction models for the DLPT Listening and DLPT Reading datasets for individual languages using raw scores (not converted ILR scores) with the three main predictors (COG, APT, and ATT). Phase III involved running latent growth prediction models for the DLPT Listening and DLPT Reading datasets for individual languages using raw scores with the subtests of the predictor variables that were significant in previous analyses (from Phase II). Phase IV involved running latent growth prediction models for the DLPT Listening and Reading datasets for individual language using raw scores with the subtests of the predictor variables that were significant in the previous analysis (Phase III) along with additional predictor variables expected to impact language proficiency change over time (GPA, age, education level (EDUC), number of language training hours (TRN_HRS), billet, sex). (For results see Chapter 5.)

Due to the large number of results reported in this study, Tables 164, 165, 166, and 167 provide a summary of the regression weight results. Only the statistically significant regression weights were included in these tables. If regression weights are not listed in these tables, they were either not significant or not included in the analysis described in the table.

Table 164. Summary of Significant Regression Weight Results from Final Models: DLI Language Difficulty Categories I, III, IV Listening and Reading

	DLI I Listening		DLI I Reading		DLI III Listening		DLI III Reading		DLI IV Listening		DLI IV Reading	
	I	**S**	**I**	**S**	**I**	**S**	**I**	**S**	**I**	**S**	**I**	**S**
COG	.488**	–	1.033*	–	.544*	–	.769*	–	.219**	–	.692*	–
APT	.869*	–	1.025*	–	.370*	–	.435*	–	.548*	–	.588*	–
ATT	–	–	–	–	–	-.212**	–	–	–	–	-.241*	–

*p < .001 **p < .05

Note: I = intercept; S = slope. Only significant results are included in table.

Table 165. Summary of Significant Regression Weight Results from Final Models: Spanish & Persian

Phase		Spanish Listening		Persian Listening		Persian Reading	
		I	**S**	**I**	**S**	**I**	**S**
Phase II							
	COG	.613**	–	.827*	–	1.107*	–
	APT	1.022*	–	.444*	–	.625*	–
	ATT	–	–	–	–	.308**	–
Phase III							
	ASVAB WK	.768*	-.474**	.467*	–	.594*	–
	ASVAB PC	–	–	.434*	–	.667*	–
	ASVAB AR	–	–	.386**	–	–	–
	ASVAB MK	–	–	–	–	.474*	–
	DLAB PT1	.601**	–	.236**	–	–	.174**
	DLAB PT2	.557**	–	–	.291**	–	–

Phase		Spanish Listening		Persian Listening		Persian Reading	
	DLAB PT3	.760*	–	.368**	–	.377**	–
	DLAB PT4	–	–	–	–	–	–
	ATT	–	–	–	–	.406**	–
Phase IV							
	ASVAB WK	.438**	–	.430*	–	.493*	–
	ASVAB PC	–	–	.322**	–	.502*	–
	ASVAB AR	–	–	.233**	–	–	–
	ASVAB MK	–	–	–	–	.264**	–
	DLAB PT1	–	–	–	–	–	–
	DLAB PT2	.438**	–	–	.277**	–	–
	DLAB PT3	–	–	-.221**	–	–	–
	DLAB PT4	–	–	–	–	–	–
	ATT					.270**	
	GPA	2.033*	–	2.536*	–	2.163*	.207**
	AGE	.725**	-.668**	-.380*	–	–	–
	EDUC	–	–	–	–	–	.281**
	TRN_HRS	–	–	–	–	–	–
	BILLET	–	–	–	–	–	.434**
	SEX	–	–	.405**	–	–	–

*p < .001 **p < .05

Note: I = intercept; S = slope. Only significant results are included in table.

Table 166. Summary of Significant Regression Weight Results from Final Models: Russian & Chinese

Phase		Russian Listening		Russian Reading		Chinese Listening		Chinese Reading	
		I	S	I	S	I	S	I	S
Phase II									
	COG	.877*	–	1.131*	–	–	–	.484*	–
	APT	–	–	.744*	–	.832*	–	.987*	–
	ATT	–	-.539**	–	-.471**	–	–	–	–
Phase III									
	ASVAB WK	.564**	–	1.017*	–	–	–	–	–
	ASVAB PC	.538**	–	.397**	–	.307**	–	.359**	–
	ASVAB AR	.575**	–	.492**	–	–	–	–	–
	ASVAB MK	–	–	.355**	–	–	.313**	–	–
	DLAB PT1	–	–	–	–	–	.441**	.393*	–
	DLAB PT2	–	–	–	–	.416**	–	–	–
	DLAB PT3	–	–	–	–	.348**	–	.583*	–
	DLAB PT4	–	–	–	–	.444**	–	.761*	–
	ATT	–	-.503**	–	-.470**	–	–	–	–

Phase		Russian Listening		Russian Reading		Chinese Listening		Chinese Reading	
Phase IV									
	ASVAB WK	.399**	–	.828*	–	–	–	–	–
	ASVAB PC	.588*	–	.437**	–	.421**	–	.316**	–
	ASVAB AR	–	–	–	–	–	–	–	–
	ASVAB MK	–	–	–	–	–	–	–	–
	DLAB PT1	–	–	–	.556**	-.275*	.425**	–	–
	DLAB PT2	–	–	–	–	–	–	–	–
	DLAB PT3	–	–	–	–	–	–	–	–
	DLAB PT4	–	–	.512**	–	.287**	–	.664*	–
	ATT	–	-.505**	–	-.496**	–	–	–	–
	GPA	2.634*	–	2.178*	–	2.169*	.621*	2.220*	.414**
	AGE	–	–	–	–	-.699*	.571**	–	–
	EDUC	-.544**	–	–	–	–	–	–	–
	TRN_HRS	–	–	–	–	–	–	–	.617*
	BILLET	–	–	–	–	–	–	–	–
	SEX	–	–	–	.915**	–	–	–	–

Table 167. Summary of Significant Regression Weight Results from Final Models: Korean & Arabic

Phase		Korean Listening		Korean Reading		Arabic Listening		Arabic Reading	
		I	**S**	**I**	**S**	**I**	**S**	**I**	**S**
Phase II									
	COG	.644*	–	1.025*	–	.695*	–	1.036*	–
	APT	–	–	.755*	-.468**	.713*	–	.874*	–
	ATT	–	–	–	–	–	–	–	–
Phase III									
	ASVAB WK	–	–	–	–	.750*	–	.666*	–
	ASVAB PC	.608**	-.194**	–	.602*	–	–	.343**	–
	ASVAB AR	–	–	.564**	-.566**	.452**	–	.344**	–
	ASVAB MK	.819*	–	.571**	–	–	–	.407**	–
	DLAB PT1	–	–	.442**	–	.402**	–	.358*	–
	DLAB PT2	–	–	–	–	.607*	–	–	–
	DLAB PT3	–	–	–	–	–	–	.611*	–
	DLAB PT4	.506**	–	.534**	-.492**	–	–	–	–
Phase IV									
	ASVAB WK	–	–	–	–	.399*	–	.552*	–
	ASVAB PC	.421**	-.263**	.391**	–	–	–	.320**	–
	ASVAB AR	–	–	.666*	–	–	–	.281**	–
	ASVAB MK	–	–	–	–	–	–	.225**	–
	DLAB PT1	–	–	–	–	–	–	–	–
	DLAB PT2	–	–	–	–	–	–	–	–

Phase		Korean Listening		Korean Reading		Arabic Listening		Arabic Reading	
	DLAB PT3	–	–	–	–	–	–	–	–
	DLAB PT4	–	–	.524**	-.501**	–	–	–	–
	GPA	2.914*	–	2.042*	–	3.273*	–	2.593*	.513*
	AGE	-512**	.227**	–	.506**	–	–	–	–
	EDUC	–	–	–	–	–	–	–	–
	TRN_HRS	–	–	–	–	–	.971*	–	.568**
	BILLET	–	–	–	–	–	–	–	–
	SEX	–	–	–	–	1.054*	–	–	–

Research Questions

The results from the four phases of analyses described in Chapters 4 and 5 suggest impacts of non-cognitive and cognitive variables on language proficiency outcomes for this population of adult language learners. In this section of Chapter 6, the five research questions are presented and the results from across all four phases are discussed. In addition, the discussion includes suggestions for future research, including topics and guidelines that should be considered.

***Research Question 1*:** Which of the three predictor variables (general cognitive ability, language aptitude, attitude towards language learning) is the best predictor of language proficiency growth over time?

One of the findings of this study is that overall, the participants experienced limited language proficiency growth. This was true across all the analyses. The limitation in growth may at least in part be due to the nature of the records included in the datasets. The datasets only included military service members who attended and graduated from DLI. Therefore, there is a natural truncation of scale of the outcome variables (DLPT Listening and Reading) because most scores are in the ILR 2 to ILR 3 range. In addition, in most cases, only military service members who obtain high scores on the ASVAB and DLAB qualify to study at DLI, so the range of scores on the ASVAB and DLAB are also restricted. Therefore, the true predictive values and covariances may be higher than those reported. However, there was still opportunity for growth, even within the limited scales, especially because of the unique inclusion of raw scores in the current study for the individual language analyses. Despite the limited growth, the results imply that some predictors did have an impact on language proficiency change. Phase I results revealed that the only predictor that had a significant regression weight on the slope was attitude towards assigned language. The regression weight was negative for DLI Language Difficulty Category III listening (-.212). This result is not expected because students who have a better attitude towards learning a particular language would be expected to be more motivated to study the language. This result could be an artifact of this predictor only being measured by one Likert item or it could be a result of a change in attitude towards the assigned language. As in Lett and O'Mara's (1990) study, it may be that some of the cognitive and non-cognitive variables predictive power was negatively impacted by the restricted sample.

Phase III results revealed that ASVAB WK had a significant negative regression weight on the slope (-.474) for Spanish listening, ASVAB PC had a significant negative regression weight on the slope for Korean listening (-.194) and a positive significant regression weight on the slope for Korean reading (.602), ASVAB MK had a significant positive regression weight on the slope for Chinese listening (.313), and ASVAB AR had a significant negative regression weight on the slope for Korean reading (-.566). The results from the subtests of the ASVAB confirm the importance of using the subtest scores in analyses and not only the overarching ASVAB or AFQT scores. As these results indicate, the individual subtests within the ASVAB may have different impacts on language proficiency change and those differences will likely vary not only by language but also by modality. Considering the high stakes nature of the subtest results, results from this study should not be used to draw conclusions regarding the impact of the knowledge and skills tested within these subtests and their impacts on specific language modalities. However, these results could be used to justify the need for further research on the impact of the various knowledge and skills tested within these subtests (word knowledge, paragraph comprehension, math knowledge, arithmetic reasoning) and their impact on language proficiency change. In addition, these results highlight the importance of considering the potential impact of these knowledge and skills on individual language and modality proficiency change and limiting generalizations to more than one skill or more than one language in the same DLI Language Difficulty Category.

Phase III results also revealed that subtests of the DLAB were significant predictors of language proficiency change; however, just as with the ASVAB subtests results, the results were not consistent between languages or even between modalities of the same language. DLAB PT1 had a significant positive regression weight on the slope (.174) for Persian reading and for Chinese listening (.441), DLAB PT2 had a significant positive regression weight on the slope (.291) for Persian listening, and DLAB PT4 had a significant negative regression weight on the slope for Korean reading (-.492). Just as with the subtests of the ASVAB, these results indicate the importance of not only considering the overall DLAB scores, but the subtests scores as well and their impact on language proficiency change. The results suggest that the individual subtests of the DLAB and the aspects of language aptitude that they measure may have different impacts on language proficiency change and those differences will likely vary not only by language but also by modality. However, just as with the ASVAB results, these results should not be used to make assumptions regarding the impact of the knowledge and skills tested within these subtests and their impacts on specific language modalities, especially considering the high stakes nature of the results of these subtests. These results could be used, however, to justify the need for further research on the impact of the components of language aptitude within these subtests (biographical qualities, stress patterns, grammar, picture-word association) and their impact on language proficiency change. In addition, these results highlight the importance of considering the impact of these individual language aptitude components on language proficiency change and the importance of limiting generalizations regarding the impact of these components on more than one skill or more than one language in the same DLI Language Difficulty Category.

In Phase III, ATT had a significant negative regression weight on the slope for Russian listening (-.503) and reading (-.496). Just as was with Phase II, these result were not expected because students who have a more positive attitude towards learning a language would be expected to experience more language proficiency growth; however, this result indicates the opposite. This could be due to limited nature of the measurement of ATT for this study or perhaps, since ATT's predictive power is maintained in Phase III despite the addition of other variables, those military service members who initially entered DLI with a negative attitude towards learning Russian eventually developed motivation to maintain and improve their language proficiency levels. This is not out of the question, especially considering these results were for Russian, which has recently become an increasingly important language within the DOD community.

Phase IV results included other predictors (GPA, age, education level, number of training hours, billet, and sex) in addition to the significant predictors from Phase III. Once the other predictors were entered into the models, some of the predictors that were found to be significant predictors of the slope in Phase III or II were no longer significant, implying that the new predictors added to the model with significant regression weights were stronger predictors of the slope. For Phase IV, ATT maintained a significant negative regression weight on the slope for Russian listening (-.505) and reading (-.496), ASVAB PC maintained a significant negative regression weight on the slope for Korean listening (-.263), and DLAB PT4 maintained a significant negative regression weight on the slope for Korean reading (-.501). These results indicate that only ATT, ASVAB PC, and DLAB PT4 maintained predictive power on the slope once additional factors were entered into the models in Phase IV. This could be partially because of the limitation in language proficiency growth and the truncation of the ILR scale due to the restricted sample. The only subtests of the main predictors that remained significant in the final models all had negative regression weights, implying that those with lower scores on those subtests were more likely to experience growth. This result is not expected because based on previous literature those with higher levels of general cognitive ability and language aptitude and a more positive attitude towards learning their assigned language would be expected to experience more success in learning second languages. However, it could be that those participants who did experience more growth did so because of individual differences or external factors that were not considered in this study. For example, these participants may have experienced more frequent and high-quality use of their second languages.

Although not included in the original research question, predictors beyond the main predictors and their subtests were significant predictors of the slope. GPA had a significant positive regression weight on the slope for Persian reading (.207), Chinese listening (.621), Chinese reading (.414), and Arabic reading (.513). For Persian and Arabic reading and for both Chinese listening and reading, participants who had higher GPAs while at DLI were more likely to experience growth. Higher GPAs could be due to the alignment between instructional materials and the content on the DLPT. Another possibility is that good study habits and time management skills that helped participants achieve higher GPAs also helped them maintain and improve their language skills after DLI. Higher GPAs could also be due to higher levels of general cognitive ability or language aptitude; however, if this were the case, then it would be expected that these factors or their subtests would also have had positive regression weights on the slope. Additional research would need to be conducted to determine what exactly helped these participants earn higher GPAs and experience more growth as there are several possibilities.

Age was another predictor added in Phase IV that had significant regression weights on the slopes. Age had a significant negative regression weight on the slope for Spanish listening (-.668), a significant positive regression weight on the slope for Chinese listening (.571) and Korean listening (.227). For Spanish listening, participants who were younger when starting at DLI experienced more growth, and for Chinese and Korean listening, those who were older when starting at DLI experienced more growth. All military service members who attend DLI are at least 18 years old. The age range for this study's sample was 18 to 39. Therefore, age in this study does not have implications for age of acquisition research; however, it is interesting that younger adult participants experienced more growth in Spanish, a DLI Language Difficulty Category I language, and older adult participants experienced more growth in both Chinese and Korean, both DLI Language Difficulty Category IV languages. This result could be due to different language use patterns for different languages. Future research could examine the impact of age further by separating the dataset into smaller datasets and comparing across different age groups.

Other predictors that had significant regression weights on the slope in the Phase IV analyses included education level, training hours, billet, and sex. Education level had a significant positive regression weight on the slope for Persian reading (.281). For Persian reading, those participants with higher levels of education when beginning at DLI experienced more growth. Higher levels of education in this study indicates that these participants had a college education before beginning at DLI. Attending and studying for courses at a college or university could have provided these participants with an advantage because they had already developed study and time management skills and understood the level of commitment required to be successful within higher level educational institution, which could translate to having the skills required to maintain and improve second language skills. Training hours had a significant positive regression weight on the slope for Chinese reading (.617), Arabic listening (.971), and Arabic reading (.568). Participants with more DOD language training hours were more likely to experience growth in Chinese reading, Arabic listening, and Arabic reading. The DOD offers high quality language learning opportunities and courses and attending quality training is beneficial when trying to improve language skills, so this result is not unexpected. However, it is interesting that only the participants in two DLI Language Difficulty Category IV languages, and only in one modality for Chinese, experienced more growth because of attending more training. Future research could be conducted to determine if this result is due to the quality or variety of learning opportunities offered by DOD in different languages and modalities or how closely aligned the instructional materials are to the content on the DLPT. Billet had a significant positive regression weight on the slope for Persian reading (.434); those participants taking the Persian reading DLPT and who were on a P3 billet (DOD billet) were more likely to experience growth than those who were on a P2 billet (military service branch billet). This distinction is important because when military language analysts are on a P3 billet they are more likely to be working in a position that requires consistent use of their second language. Additional research could investigate why this factor only impacted Persian reading growth; however, for Persian reading, this result implies that participants benefited from more consistent use of their second or target language. Sex had a significant positive regression weight on the slope for Russian reading (.915), implying that males experienced more growth than females

Although the results do not suggest that any of the main predictors stand out as the best predictor of language proficiency growth, the results do provide insight into predictors that impact language proficiency growth. In addition, the results provide justification for including the subtests and not just the overall scores for general cognitive ability and language aptitude tests like the ASVAB and DLAB because the individual subtests may differ in their predictive influence on language proficiency change. The results also indicate that the predictive influence of cognitive and non-cognitive variables, such as those included in this study, varies between modalities and languages, even those in the same DLI Language Difficulty Category, so whenever possible, separate analyses should be conducted for each language and each modality.

Although this study did not provide strong evidence for determining which of the main predictor variables is the best predictor of language growth, the results do provide insight into additional factors that may impact language proficiency growth, for which very limited research exists, and the results also clearly suggest areas and guidelines for future research.

Research Question 2**:** Does the extent to which the predictor variables (cognitive ability, language aptitude, and motivation) predict initial levels of proficiency vary by language difficulty category?

The results from this study imply that the predictive value of the main predictor variables on the initial level of proficiency does differ by language difficulty category. In fact, not only do they vary by language difficulty category, but by language and modality. Both COG and APT had significant regression weights on the intercepts for all DLI Language Difficulty level analyses. For DLI Language Difficulty Category I Listening and DLI Language Difficulty Category IV Listening, APT was the strongest predictor of initial proficiency levels. For DLI Language Difficulty Category I Reading, APT and COG had very similar predictive values, with COG having a slightly higher value (1.035 and 1.021). For DLI Language Difficulty Category III Listening and Reading and DLI Language Difficulty Category IV Reading, COG was the strongest predictor of initial proficiency levels. ATT had a negative predictive value for the initial proficiency level for DLI Language Difficulty Category IV Reading. The individual language analyses also indicate variation in the results between languages and modalities. COG had significant regression weights on the intercepts for all individual language analyses, and APT had significant regression weights on the intercepts for all except for Russian and Korean listening. COG had a higher predictive value for Persian listening and reading, Russian listening and reading, Korean listening and reading, and Arabic reading. APT had a higher predictive value for Spanish listening, Chinese listening and reading, and Arabic listening. Therefore, COG had a higher predictive value for both DLI Language Difficulty Category III languages (Persian and Russian), both modalities for one DLI Language Difficulty Category IV language (Korean), and for reading for one other DLI Language Difficulty Category IV language (Arabic). APT had a higher predictive value for DLI Language Difficulty Category I listening (Spanish), both modalities for one DLI Language Difficulty Category IV language (Chinese), and for listening for one other DLI Language Difficulty Category IV language (Arabic). ATT had a positive regression weight on the intercept for Persian reading; however, the value was lower than the predictive value of APT and COG.

In addition to considering the results for the DLI Language Difficulty Category analyses and Phase II individual language analyses, the Phase III individual language analyses that included the COG and APT subtests need to be considered. Just as was the case for the Phase II analyses, the Phase III results indicate variation in the predictive value of the predictors on the initial level of language proficiency not only by language, but also modality. For Spanish listening, APT was a stronger predictor than COG in the Phase II analyses. In Phase III, ASVAB WK was the strongest predictor out of the subtests; however, it only had a slightly higher regression weight than DLAB PT3. For Persian listening and reading, COG was the strongest predictor in Phase II and in Phase III ASVAB WK was the strongest predictor for listening and ASVAB PC was the strongest predictor for reading. In Phase II, COG was the strongest predictor for Russian listening and reading, in Phase III, ASVAB AR was the strongest predictor for listening and ASVAB WK was the strongest predictor for reading. For Chinese listening and reading, in Phase II APT was the strongest predictor and that stayed consistent in Phase III; DLAB PT4 was the strongest predictor for both listening and reading. In Phase II, COG was the strongest predictor for Korean listening and reading and in Phase III, ASVAB MK was the strongest predictor. For Arabic listening and reading, in Phase II APT was the strongest predictor for listening and COG was the strongest predictor for reading. In Phase III, ASVAB WK, a subtest for COG, was the strongest predictor for both listening and reading. The Spanish listening and Arabic listening results from Phase III were the only results that were not entirely consistent with Phase II results in terms of strength of the predictors; however, beyond the strength of the predictors, the results were consistent with Phase II.

Although the other predictors included in Phase IV were not referenced in the research question, it is helpful to consider these results as well. In Phase IV, GPA had the highest regression weights on the intercepts out of all the factors included in Phase IV. AGE had a significant positive regression weight on the intercept for Spanish listening and a negative regression weight on the intercept for Korean listening and Chinese listening. EDUC had a significant negative regression weight for Russian listening. SEX had a positive significant regression weight for Arabic listening and Persian listening. The remainder of the factors were either not relevant for the initial proficiency levels (TRN_HRS and BILLET). The factors included in Phase IV showed variation in predictive values on initial language proficiency both between languages and modalities. The only except was GPA, which was the strongest predictor out of all predictors.

The results clearly indicate that the predictive value of the main predictors (COG, APT, ATT) varies by language difficulty category and, in some cases, modality. COG was expected to be a stronger predictor for DLI Language Difficulty Category I languages and APT was expected to be stronger predictor for DLI Language Difficulty Category III and IV languages based on results from previous studies (Lett & O'Mara, 1990; Doughty, 2019). However, the results of this study suggest that the strength of the predictors is more likely to differ between not just DLI Language Difficulty Categories, but also between languages and modalities. COG was the strongest predictor for listening and reading for both DLI Language Difficulty Category III languages, Persian and Russian; listening and reading for Korean, a DLI Language Difficulty Category IV language; and reading for Arabic, another DLI Language Difficulty Category IV language. APT was the strongest predictor for listening for the only DLI Language Difficulty Category 1 language, Spanish; both listening and reading for Chinese, a DLI Language Difficulty Category IV language; and listening for Arabic, another DLI Language Difficulty Category IV language. Therefore, the results for COG and APT are not consistent among DLI

Language Difficulty Categories or modalities, suggesting the influence of general cognitive aptitude and language aptitude on language proficiency may vary by language and even modality within the same language.

The results from Phase III, which included the results from the subtests of both COG and APT, were mostly consistent with the results from Phase II. Except for Arabic listening and Spanish listening, when COG or APT was the strongest predictor in Phase II, one of their subtests was the strongest predictor in Phase III. For both Spanish and Arabic listening, APT was the strongest predictor in Phase II; however, in Phase III, ASVAB WK was a stronger predictor than any of the DLAB subtests. The results from Phase III also provide insight into the usefulness of the subtests in predicting initial level of language proficiency. For COG, measured by the ASVAB, ASVAB WK, which measures word knowledge, had a significant predictive value for all languages and modalities except for Korean and Chinese. ASVAB PC, which measures paragraph comprehension, had a significant predictive value for all languages and modalities except for Spanish listening. ASVAB AR, which measures arithmetic reasoning, had a significant predictive value for both Arabic and Russian listening and reading, for Korean reading, and for Persian listening. ASVAB MK, which measures mathematical knowledge, had a significant predictive value for Korean listening and reading and for Arabic, Russian, and Persian. For APT, measured by the DLAB, DLAB PT1, a biographical questionnaire, had a significant predictive value for Arabic listening and reading, Korean and Chinese reading, and Persian listening. DLAB PT2, which measures perception of speech patterns, had a significant predictive value for Arabic, Chinese, and Spanish listening. DLAB PT3, which requires application of grammar rules to an artificial language, had a significant predictive value for Chinese and Persian reading and listening, Arabic reading, and Spanish listening. DLAB PT4, which requires formation of language concepts from pictures using an artificial language, had a significant predictive value for Korean and Chinese listening and reading. All predictive values described were positive. The only exceptions were the predictive values of DLAB PT1 on Chinese Listening and DLAB PT3 on Persian listening, which were both negative. These results reveal that just as there was variability in predictive value by language and modality for the overall scores for the ASVAB and DLAB, the predictive value of the subtests differ by language and modality, highlighting the importance of considering all components of measures of general cognitive ability and language aptitude when trying to determine an individuals' likelihood to experience success in learning a second language. The results from Phase II and Phase III also provide support for the consideration of each individual language and modality instead of generalizing based on a language's assigned DLI Language Difficulty Category. While results from previous research (Lett & O'Mara, 1990) suggested that the ASVAB is better at predicting success in DLI Language Category I languages and the DLAB is better at predicting success in DLI Language Category III and IV languages, the results from the current study suggest that this may be too much of a generalization, and the subtests of these tests may vary in how they impact each individual language and modality. These results provide justification for further research that investigates the various components of the ASVAB and DLAB and their impact on language proficiency outcomes.

Except for GPA, the significance and strength of the predictive value of the other factors included in the study in Phase IV also varied by both language and modality. GPA was the strongest predictor and had significant predictive values for both modalities for all languages. It is not surprising that those participants who experienced success at DLI in terms of achieving higher grades also performed better on the DLPT; instructional materials may be in alignment with the content on the DLPT. These participants could have better study skills and time management skills, or it could be due to the participants' higher levels of general cognitive aptitude or language aptitude. GPA did have significant covariances with the ASVAB and DLAB subtests across modalities and languages. Additional research that includes additional data points on participants at DLI could investigate what exactly contributed to these participants' earning higher GPAs. The only other factors that had significant predictive values for initial levels of language proficiency were AGE, EDUC, and SEX. AGE had a significant positive regression weight on the intercept for Spanish listening, implying that those participants who were older when beginning their studies at DLI were more likely to perform better on the Spanish listening DLPT. AGE had a significant negative regression weight on the intercept for both Korean and Chinese listening, suggesting that those who were younger when studying at DLI were more successful on the Korean listening and Chinese listening DLPT. EDUC had a significant negative regression weight on the intercept for Russian listening; this result implies that those who arrived at DLI with fewer years of education, most likely high school graduates, were more successful on the initial Russian listening DLPT. Lastly, SEX had a significant positive regression weight on the intercept for both Arabic and Persian listening which implies that males were more successful than females on the initial Arabic and Persian listening DLPTs.

In summary, the results from Phases I, II, III, and IV all support the conclusion that the predictive value of the predictors included in this study on initial values of language proficiency differ by not only DLI Language Difficulty Category, but by individual language and modality as well.

Research Question 3: Do the predictor variables (cognitive ability, language aptitude, and motivation) interact with one another?

The results from this study indicate that cognitive ability and language aptitude are related to one another; COG and APT had significant covariances in all Phase I analyses (DLI Language Difficulty Category I, III, and IV Listening and Reading) ranging from .347 to .400 (p <.001) and in all Phase II analyses (listening and reading for Spanish, Persian, Russian, Chinese, Korean, Arabic) ranging from .301 to .422 ($p < .001$). APT and ATT also had significant covariances in several Phase I analyses although the covariances were not as strong and consistent as those between cognitive ability and language aptitude. The covariances for DLI Language Difficulty Category I Listening and Reading were .091 and .088 with $p < .05$. The covariances for DLI Language Difficulty Category III Listening, DLI Language Difficulty Category IV Listening, and DLI Language Difficulty Category IV Reading ranged from .113 to .148 ($p < .001$). The covariance for DLI Language Difficulty Category III Reading was strong but negative, -.544 ($p < .05$). For the Phase II analyses, the covariances between APT and ATT ranged from .060 to .164 ($p < .001$) for Persian Listening, Russian Listening and Reading, and Chinese Listening and Reading, Korean Listening and Reading, and Arabic Listening. COG and ATT had significant covariances as well, but only for in Phase II; the covariance for Chinese Listening was .101 and for Chinese Reading it was .104 ($p < .05$).

The results from both Phase I and II analyses confirm the relationship between general cognitive aptitude and language aptitude; the covariances between COG and APT were all significant and positive for all Phase I and II analyses. Previous related research found significant interactions between general cognitive ability and language aptitude (e.g., Mackey, 2014), so this result was expected, but it does provide further support for the relationship between these two variables and their important role in the process of adult second language acquisition. While the results from Phase I and II analyses also confirm that there is a relationship between language aptitude and attitude towards assigned language, the results are not as consistent, implying that while there is a relationship between these two predictors, it varies in strength and even direction by both language and modality. Previous research suggested a potential relationship between language aptitude and motivation, a variable potentially related to the one measured in this study (attitude towards learning assigned language). Only the Chinese Listening and Reading results from Phase II provided support for a relationship between general cognitive ability and attitude towards assigned language implying that while potential exists for a relationship between these two variables, it is not a consistent relationship.

The results from Phases I and II confirm consistent and positive relationships between general cognitive ability and language aptitude. The relationships between attitude towards assigned language and general cognitive ability and attitude towards assigned language and language aptitude were not as consistent and varied by direction and significance between DLI Language Difficulty Category levels and modalities.

***Research Question 4*:** Is the shape of the language proficiency growth trajectories homogenous or does it differ between individuals?

Research Question 5: Is the shape of the language proficiency growth trajectories mediated by language difficulty category?

Due to the overlapping nature of Research Questions 4 and 5, they will be discussed together. The intercepts and slopes in the analyses performed in this study were estimated based on individual participant growth trajectories. Therefore, the variances of the intercepts and slopes should be considered when determining the amount of variability among participants. The significant variances are in Tables 168, 169, 170, 171 and 172. In several of the analyses performed in this study, the slope variances had to be set to constants, so that the models would converge; these are noted in the tables.

Table 168. Summary of Significant Variance Results from Final Models: DLPT Listening and Reading

	DLPT Listening		DLPT Reading	
	I	**S**	**I**	**S**
Variance	17.787*	2.00*	10.662*	***

*p < .001 **p < .05 *** set to 1.0

Table 169. Summary of Significant Variance Results from Final Models: DLI Language Difficulty Categories I, III, IV Listening and Reading

	DLI I Listening		DLI I Reading		DLI III Listening		DLI III Reading		DLI IV Listening		DLI IV Reading	
	I	**S**	**I**	**S**	**I**	**S**	**I**	**S**	**I**	**S**	**I**	**S**
Variance	16.671*	7.156*	9.041*	***	12.989*	1.476*	10.284*	***	19.344*	2.001*	8.382*	1.244*

*p < .001 **p < .05 *** set to 1.0

Note: I = intercept; S = slope. Only significant results are included in table.

Table 170. Summary of Significant Variance Results from Final Models: Spanish, Persian & Russian

Phase		Spanish Listening		Persian Listening		Persian Reading		Russian Listening		Russian Reading	
		I	**S**	**I**	**S**	**I**	**S**	**I**	**S**	**I**	**S**
Phase II											
	Variance	21.291*	6.474*	17.500*	.622*	12.592*	***	19.926*	***	13.952*	***
Phase III											
	Variance	20.939*	6.709*	17.112*	.430*	8.890*	***	19.492*	***	13.344*	***
Phase IV											
	Variance	17.407*	6.167*	11.046*	.362*	4.119*	***	12.774*	***	9.018*	***

*p < .001 **p < .05 *** set to 1.0

Note: I = intercept; S = slope. Only significant results are included in table.

Table 171. Summary of Significant Variance Results from Final Models:

Phase		Chinese Listening		Chinese Reading		Korean Listening		Korean Reading	
		I	S	I	S	I	S	I	S
Phase II									
	Variance	12.117*	.455	10.409*	.431	24.687*	***	11.090*	5.438*
Phase III									
	Variance	11.867*	.451	10.258*	.371	24.266*	***	10.837*	3.626
Phase IV									
	Variance	7.330*	6.698*	6.043*	.010	16.290*	***	7.191*	6.291**

*p < .001 **p < .05 *** set to 1.0

Note: I = intercept; S = slope. Only significant results are included in table.

Table 172. Summary of Significant Variance Results from Final Models: Arabic

Phase		Arabic Listening		Arabic Reading	
		I	S	I	S
Phase II					
	Variance	21.695*	.739	10.063*	.922
Phase III					
	Variance	21.383*	.709	9.918*	.788
Phase IV					
	Variance	11.461*	.097	3.878*	.150

*p < .001 **p < .05 *** set to 1.0

Note: I = intercept; S = slope. Only significant results are included in table.

The intercept variances for all final models for all analyses were significant ($p < .001$), implying that there were inter-individual differences in the DLPT initial scores for individuals even for those participants within the same language difficulty level and the same language. For all individual language analyses, the intercept variances decreased from Phase II to Phase IV indicating that the significant predictors did account for some of the inter-individual differences; however, the intercept variances all remained significant in Phase IV suggesting that there are other individual difference factors that were not included in this study that contributed to the variances.

The slope variances were significant for the final models in these analyses: DLPT Listening, DLI Language Difficulty Category I Listening, DLI Language Difficulty Category III Listening, DLI Language Difficulty Category IV Listening, DLI Language Difficulty Category IV Reading, Spanish Listening, Persian Listening, Korean Reading Phase II and Phase IV, and Chinese Listening Phase IV. Therefore, for these models, there were significant inter-individual differences in growth rates; there were significant differences in the participants' growth trajectories. The slope variances were not significant for the final models in these analyses: Chinese Listening (except for Phase IV), Chinese Reading, Korean Reading Phase III, Arabic Listening, and Arabic Reading. Slope variances that were not significant suggest that there were not significant differences in participant growth rates or growth trajectories. The slope variance was set to a constant, 1.0, so the final models would converge for these analyses: DLPT Reading, DLI Language Difficulty Category I Reading, DLI Language Difficulty Category III Reading, Persian Reading, Russian Listening, Russian Reading, and Korean Listening. Therefore, these slope variances do not reflect the true slope variances. This is a limitation; however, setting the slope variance to a constant did enable the models to converge and setting the slope variance and intercept-slope covariance to a constant did not limit the interpretations of the other parameters and predictor regression weights.

Except for DLPT Reading and DLI Language Difficulty Category I and DLI Language Difficulty Category III Reading, which had slope variances set to 1.0, all Phase I analyses had significant slope variances, suggesting that when grouped together by language difficulty category, participants had different growth rates or trajectories. Once participants were separated into their individual language groups in the analyses, some of the slope variances remained significant indicating that even between those participants assigned to the same language that there were differences in growth trajectories (Spanish Listening, Persian Listening, Korean Reading (Phases II and IV), and Chinese Listening Phase IV.) Korean Reading had interesting results because the slope variance was significant for Phase II, not significant for Phase III, and significant for Phase IV. This result implies that inter-individual differences in growth rates were detected for Phases II and IV but not for Phase III. This is likely because once the predictors were included in the final model for Phase III, 18L, they accounted for enough of the inter-individual variability in growth rates to result in a slope variance that was not significant. Both DLAB PT4 and ASVAB MK had significant negative regression weights on the slope for model 18L. For Phase IV, adding additional predictors to the model may have resulted in higher power to detect slope variability; the slope varied as a function of the significant predictors. Model 18N, the final model of Phase IV for Korean Reading had two significant predictors: DLAB PT4, from Phase III, with a significant negative regression weight on the slope and AGE, with a positive regression weight on the slope. The slope variances for Chinese Listening are also worth examining in more detail. For both Phases II and III, the slope variances were not significant, suggesting that there were not inter-individual differences in growth rates; however, the final model for Phase IV, 15N, did have a significant slope variance. This is likely due to the addition of two predictors, GPA and AGE, which both had significant positive regression weights on the slope. The addition of GPA and AGE to the model likely led to an increase in power to detect slope variability; the slope varied as a function of both GPA and AGE. The results from both the Korean Reading and Chinese Listening analyses exemplify the power that predictors may have on detecting inter-individual differences in growth rates.

The results from this study suggest that there are inter-individual differences in growth rates and trajectories among individuals assigned to languages within the same DLI Language Difficulty Category. Once the participants were grouped into their assigned languages, the results varied by language and even modality. Significant inter-individual differences in growth rates and trajectories were detected for all final models for Spanish Listening and Persian Listening and for Phases II and IV of the Korean Reading analyses and Phase IV of the Chinese Listening analyses. The slope variances for the final models for the other analyses were either not significant (Chinese Listening Phases II and III, Chinese Reading, Korean Reading Phase III, Arabic Listening, Arabic Reading), indicating that there were not inter-individual differences in growth rates, or set to 1.0 so that the models would converge (DLPT Reading, ILR I Reading, ILR III Reading, Persian Reading, Russian Listening, Russian Reading, and Korean Listening). For the analyses that resulted in slope variances that were not significant, it could be that there were inter-individual differences in growth rates but that the predictors included in the models accounted for the existing differences between individuals. Results from previous research (Wagener, 2016; Mackey, 2014) suggested that growth rates and trajectories may differ between individuals assigned to languages in different language difficulty categories. The results from this study suggest that the growth rates and trajectories not only vary between individuals assigned to languages in different language difficulty categories, but also between individuals assigned to languages in the same language difficulty category and, in some cases, even between individuals studying the same language.

Limitations

Although limitations of the current study have been mentioned throughout the discussion section, they will be summarized in this section. Due to the nature of the dataset used for this study, there was a truncation in the range of DLPT scores. Only DLI graduates were included in this study, so the range of DLPT scores was primarily between ILR 2 and ILR 3. This restricted range could have impacted the predictive power of the cognitive and non-variables on the language proficiency outcomes. In addition, most military service members who qualify to go to DLI obtained high scores on the ASVAB and DLAB, so the range of scores on the ASVAB and DLAB are also restricted. Therefore, the true predictive values and covariances may be higher than those reported. The limited amount of growth in the sample also could have negatively impacted the potential predictive power of the variables. Another limitation was that this study only used nonlinear and linear models. Although the DLPT mean trajectories did not indicate that more sophisticated models or two slopes were necessary, if a different type of model were used, then perhaps the slope variance and intercept-slope variances would not have had to be set to a constant for some analyses. In addition, a more sophisticated model may have resulted in acceptable model fit (specifically CFI) indexes for Spanish Reading. Although most of the variables included in the current study were time-invariant by nature, two variables, billet and training hours, only had interpretable results for the slope; therefore, future analyses that include these variables should treat them as time-variant variables.

Chapter 7: Conclusion

This research contributes to the existing literature as one of the very few longitudinal analyses with adult second language professionals. In addition, this research is unique in that it involved multiple phases of analyses (all languages together (DLPT Listening and Reading), DLI Language Difficulty Category Level Analyses, individual language analyses) included overall measures of general cognitive aptitude and language aptitude and their subtests, and investigated the impact of nine (general cognitive ability, language aptitude, attitude towards assigned language, GPA, age, education level, training hours, billet, sex) predictors (fifteen if including the subtests of general cognitive ability and language aptitude) on both initial measures of language proficiency and language proficiency change. Studies that were conducted with similar populations did not all enter one predictor at a time, and therefore were more exploratory in nature, which could have led to the predictive power of some variables being masked by other predictors. In addition, this study included individual language analyses, which enabled the unique use of raw scores for the outcome variable, the DLPT, whereas other studies have relied exclusively on converted ILR scores, which are less precise in their measurement of language proficiency.

Although there were limitations of the current study, the results provide insight into the impact of general cognitive ability and language aptitude, and their components, on language proficiency outcomes. In addition, the results suggest the impact that other variables such as attitude towards assigned language, GPA, age, education level, number of training hours, billet, and sex may have on language proficiency outcomes. While some studies have been conducted separately on these factors, to the author's knowledge, this is the only study that included all these factors.

Due to the limited amount of language proficiency growth of participants, the results do not indicate which of the main predictor variables (general cognitive ability, language aptitude, attitude towards learning assigned language) is the best predictor of language proficiency growth; however, the results do suggest that it is important to not only consider the overall measures of variables such as general cognitive ability and language aptitude, but their components as well. The predictive value of the subtests of the ASVAB and DLAB varied not only by DLI Language Difficulty Category, but by language and modality. The results also provide insight into additional factors such as GPA, age, education level, number of language training hours, billet type, and sex, and their potential impact on language proficiency growth. The predictive value of these predictors also varied by both language and modality, suggesting that future research should consider these factors and their impact on adult second language acquisition not only between languages, but also between language modalities.

The results also provide insight into the influence of the predictors on initial levels of language proficiency. The results from Phases I, II, III, and IV all support the conclusion that the predictive value of the predictors on initial levels of language proficiency differ not only by DLI Language Difficulty Category, as suggested by previous research (Lett & O'Mara, 1990; Doughty, 2019), but also by language and even language modality.

In addition, this study provides insight into the relationship between the predictors. The results from both Phase I and II analyses confirm the relationship between general cognitive aptitude and language aptitude. The results from Phase I and II analyses also support a relationship between language aptitude and attitude towards assigned language; however, the results were not consistent, implying that while there is a potential relationship between these two variables, it may vary in strength and even direction by both language and modality. The results from two individual language analyses (Chinese Listening and Reading) also suggest a potential relationship between general cognitive ability and attitude towards assigned language.

The results also provide insight into the inter-individual differences that may exist in adult learners' growth trajectories. Growth rates not only varied between participants assigned to languages in different language difficulty categories, but they also varied between participants in the same language difficulty category and, for some languages, even between individuals in the same languages.

In summary, this study succeeded in presenting results from four phases of longitudinal analyses that provide valuable and unique insight into a variety of individual difference factors and their impact on language outcomes, the relationship between these factors, and the individual differences in growth rates for adult language learners. This research is not only important for the field of second language acquisition but for the DOD as well. High stakes decisions are made based on the results of tests such as the ASVAB and DLAB, and the results from this study suggest that assumptions should not be made regarding the predictive power of one of these tests over another for DLI Language Difficulty Categories as the results indicated variation not only between DLI Language Difficulty Categories, but between languages and modalities as well. The results also provide support for the need for additional longitudinal research in the field of adult second language acquisition.

Appendix

DLPT Listening and Reading DLI Language Difficulty Category I Variances and Covariances

Table 173. DLPT Listening DLI Language Difficulty Category I Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
3B	COG	.993	.050	19.950	< .001
3C	COG	.993	.050	19.950	< .001
	APT	.929	.047	19.950	< .001
	COG < > APT	.347	.036	9.576	< .001
3D	COG	.993	.050	19.950	< .001
	APT	.929	.047	19.950	< .001
	ATT	.998	.053	18.775	< .001
	COG < > APT	.347	.036	9.576	< .001
	COG < > ATT	-.012	.037	-.309	.757
	APT < > ATT	.091	.036	2.509	.012**

**p < .05

Table 174. DLPT Reading DLI Language Difficulty Category I Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
4B	COG	.999	.050	20.062	< .001
4C	COG	.999	.050	20.062	< .001
	APT	.999	.050	20.062	< .001
	COG < > APT	.365	.037	9.744	< .001
4D	COG	.999	.050	20.062	< .001
	APT	.999	.050	20.062	< .001
	ATT	.999	.053	18.881	< .001
	COG < > APT	.365	.037	9.744	< .001
	COG < > ATT	-.001	.037	-.028	.977
	APT < > ATT	.088	.038	2.340	.019**

**p < .05

DLPT Listening and Reading DLI Language Difficulty Category III Variances and Covariances

Table 175. DLPT Listening DLI Language Difficulty Category III Variable Variances/Covariances

Model	**Variable(s) of Interest**	**Estimate**	***SE***	***C.R.***	***P***
5B	APT	1.00	.027	37.175	< .001
5C	APT	1.000	.027	37.175	< .001
	COG	1.000	.027	37.175	< .001
	COG < > APT	.356	.020	17.633	< .001
5D	COG	1.000	.027	37.175	< .001
	APT	1.000	.027	37.175	< .001
	ATT	1.000	.029	34.758	< .001
	COG < > APT	.356	.020	17.633	< .001
	COG < > ATT	.018	.020	.892	.372
	APT < > ATT	.148	.021	7.219	< .001

**p < .05

Table 176. DLPT Reading DLI Language Difficulty Category III Variable Variances/Covariances

Model	**Variable(s) of Interest**	**Estimate**	***SE***	***C.R.***	***p***
6B	APT	1.00	.027	37.155	< .001
6C	APT	1.00	.027	37.155	<.001
	COG	1.00	.027	37.155	<.001
	COG < > APT	.357	.020	17.656	<.001
6D	APT	1.00	.027	37.155	<.001
	COG	1.00	.027	37.155	<.001
	ATT	1.00	.029	34.743	<.001
	COG < > APT	.357	.020	17.656	<.001
	COG < > ATT	.018	.020	.884	.377
	APT < > ATT	-.544	.274	-1.982	.047**

**p < .05

DLPT Listening and Reading DLI Language Difficulty Category IV Variances and Covariances

Table 177. DLPT Listening DLI Language Difficulty Category IV Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
7B	APT	1.00	.018	55.254	< .001
7C	APT	1.00	.018	55.254	< .001
	COG	1.00	.018	55.254	< .001
	COG < > APT	.400	.014	29.022	< .001
7D	APT	1.00	.018	55.254	< .001
	COG	1.00	.018	55.254	< .001
	ATT	.999	.020	48.884	< .001
	COG < > APT	.400	.014	29.022	< .001
	COG < > ATT	.015	.014	1.017	.309
	APT < > ATT	.113	.015	7.760	< .001

Table 178. DLPT Reading DLI Language Difficulty Category IV Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
8B	APT	1.00	.022	44.570	< .001
8C	APT	1.00	.022	44.570	< .001
	COG	1.00	.022	44.570	< .001
	COG < > APT	.387	.017	22.747	< .001
8D	APT	1.00	.022	44.570	< .001
	COG	1.00	.022	44.570	< .001
	ATT	.999	.025	40.560	< .001
	COG < > APT	.387	.017	22.747	< .001
	COG < > ATT	.027	.017	1.539	.124
	APT < > ATT	.119	.018	6.779	< .001

**p < .05

Spanish Listening Variances and Covariances

Phase II

Table 179. Spanish Listening Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
9B	COG	.998	.057	17.421	<.001
9C	COG	.998	.057	17.421	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	APT	.998	.057	17.421	<.001
	COG < > APT	.301	.042	7.116	<.001
9D	COG	.998	.057	17.421	<.001
	APT	.998	.057	17.421	<.001
	ATT	.998	.060	16.628	<.001
	COG < > APT	.301	.042	7.116	<.001
	COG < > ATT	-.044	.042	-1.029	.304.
	APT < > ATT	.068	.043	1.593	.111

**p < .05

Phase III

Table 180. Spanish Listening Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
9E	WK	.998	.057	17.421	<.001
9F	WK	.998	.057	17.421	<.001
	PC	.998	.057	17.421	<.001
	WK < > PC	.429	.044	9.732	<.001
9G	WK	.998	.057	17.421	<.001
	AR	.998	.057	17.421	<.001
	WK < > AR	.156	.041	3.797	<.001
9H	WK	.998	.057	17.421	<.001
	MK	.998	.057	17.421	<.001
	WK < > MK	.036	.041	.893	.372
9I	WK	.998	.057	17.421	<.001
	PT3	.998	.057	17.421	<.001
	WK < > PT3	.161	.041	3.927	<.001
9J	WK	.998	.057	17.421	<.001
	PT3	.998	.057	17.421	<.001
	PT2	.998	.057	17.421	<.001
	WK < > PT3	.161	.041	3.927	<.001
	WK < > PT2	.009	.041	.226	.821
	PT3 < > PT2	.163	.041	3.965	<.001
9K	WK	.998	.057	17.421	<.001
	PT3	.998	.057	17.421	<.001
	PT2	.998	.057	17.421	<.001
	PT1	.998	.057	17.421	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	WK < > PT3	.161	.041	3.927	<.001
	WK < > PT2	.009	.041	.226	.821
	WK < > PT1	.088	.041	2.162	.031**
	PT3 < > PT2	.163	.041	3.965	<.001
	PT3 < > PT1	.058	.041	1.432	.152
	PT2 < > PT1	-.002	.041	-.042	.966
9L	WK	.998	.057	17.421	<.001
	PT3	.998	.057	17.421	<.001
	PT2	.998	.057	17.421	<.001
	PT1	.998	.057	17.421	<.001
	PT4	.998	.057	17.421	<.001
	WK < > PT3	.161	.041	3.927	<.001
	WK < > PT2	.009	.041	.226	.821
	WK < > PT1	.088	.041	2.162	.031**
	WK < > PT4	.231	.042	5.565	<.001
	PT3 < > PT2	.163	.041	3.965	<.001
	PT3 < > PT1	.058	.041	1.432	.152
	PT3 < > PT4	.047	.041	1.151	.250
	PT2 < > PT1	-.002	.041	-.042	.966
	PT2 < > PT4	-.103	.041	-2.532	.011
	PT1 < > PT4	.048	.041	1.180	.238

**p < .05

Phase IV

Table 181. Spanish Listening Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
9M	WK	.998	.057	17.421	<.001
	PT3	.998	.057	17.421	<.001
	PT2	.998	.057	17.421	<.001
	PT1	.998	.057	17.421	<.001
	GPA	1.004	.059	16.895	<.001
	WK < > PT3	.161	.041	3.927	< .001
	WK < > PT2	.009	.041	.226	.821
	WK < > PT1	.088	.041	2.162	.031**
	WK < > GPA	.121	.042	2.882	.004**

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT3 < > PT2	.163	.041	3.965	<.001
	PT3 < > PT1	.058	.041	1.432	.152
	PT3 < > GPA	.242	.043	5.661	< .001
	PT2 < > PT1	-.002	.041	-.042	.966
	PT2 < > GPA	.109	.042	2.601	.009**
	PT1 < > GPA	.154	.042	3.666	<.001
9N	WK	.998	.057	17.421	<.001
	PT2	.998	.057	17.421	<.001
	GPA	1.001	.059	16.888	<.001
	AGE	1.002	.060	16.644	<.001
	WK < > PT2	.009	.041	.226	.821
	WK < > GPA	.119	.042	2.828	.014**
	WK < > AGE	.357	.045	7.993	<.001
	PT2 < > GPA	.103	.042	2.465	.014**
	PT2 < > AGE	.042	.042	.999	.318
	GPA < > AGE	.010	.043	.227	.821
9O	WK	.998	.057	17.421	<.001
	PT2	.998	.057	17.421	<.001
	GPA	1.001	.059	16.889	<.001
	AGE	1.002	.060	16.644	<.001
	EDUC	1.001	.060	16.639	<.001
	WK < > PT2	.009	.041	.226	.821
	WK < > GPA	.118	.042	2.826	.005**
	WK < > AGE	.357	.045	7.994	<.001
	WK < > EDUC	.321	.044	7.248	<.001
	PT2 < > GPA	.103	.042	2.455	.014**
	PT2 < > AGE	.042	.042	.999	.318
	PT2 < > EDUC	.013	.042	.305	.760
	GPA < > AGE	.009	.043	.200	.841
	GPA< > EDUC	.080	.043	1.849	.064
	AGE < > EDUC	.659	.051	12.940	<.001
9P	WK	.998	.057	17.421	.152
	PT2	.998	.057	17.421	.966
	GPA	1.001	.059	16.888	<.001
	AGE	1.002	.060	16.645	<.001
	TRN_HRS	1.012	.090	11.279	<.001
	WK < > PT2	.009	.041	.226	.821
	WK < > GPA	.119	.042	2.828	.005**

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	WK < > AGE	.357	.045	7.992	<.001
	WK < > TRN_HRS	-.136	.062	-2.185	.029**
	PT2 < > GPA	.103	.042	2.461	.014**
	PT2 < > AGE	.042	.042	1.004	.315
	PT2 < > TRN_HRS	-.031	.062	-.503	.615
	GPA < > AGE	.010	.043	.221	.825
	GPA< > TRN_HRS	-.036	.063	-.566	.571
	AGE < > TRN_HRS	-.107	.064	-1.660	.097
9Q	WK	.998	.057	17.421	<.001
	PT2	.998	.057	17.421	<.001
	GPA	1.001	.059	16.888	<.001
	AGE	1.002	.060	16.644	<.001
	BILLET	.244	.016	15.264	<.001
	WK < > PT2	.009	.041	.226	.821
	WK < > GPA	.118	.042	2.826	.005**
	WK < > AGE	.357	.045	7.992	<.001
	WK < > BILLET	-.003	.023	-.128	.898
	PT2 < > GPA	.103	.042	2.468	.014**
	PT2 < > AGE	.042	.042	1.003	.316
	PT2 < > BILLET	-.043	.023	-1.880	.060
	GPA < > AGE	.010	.043	.230	.818
	GPA< > BILLET	-.017	.023	-.727	.467
	AGE < > BILLET	-.006	.024	-.272	.785
9R	WK	.998	.057	17.421	<.001
	PT2	.998	.057	17.421	<.001
	GPA	1.001	.059	16.889	<.001
	AGE	1.002	.060	16.645	<.001
	BILLET	.196	.011	17.421	<.001
	WK < > PT2	.009	.041	.226	.821
	WK < > GPA	.118	.042	2.817	.005**
	WK < > AGE	.357	.045	7.989	<.001
	WK < > SEX	.058	.018	3.179	.001**
	PT2 < > GPA	.102	.042	2.449	.014**
	PT2 < > AGE	.043	.042	1.006	.314
	PT2 < > SEX	.037	.018	2.074	.038**
	GPA < > AGE	.010	.043	.222	.824
	GPA< > SEX	-.017	.018	-.893	.372
	AGE < > SEX	.039	.019	2.078	.038**

**p < .05

Persian Listening Variances and Covariances

Phase II

Table 182. Persian Listening Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
11B	APT	.999	.034	29.453	< .001
11C	APT	.999	.034	29.453	< .001
	COG	.999	.034	29.453	< .001
	APT < > COG	.363	.026	14.206	< .001
11D	APT	.999	.034	29.453	< .001
	COG	.999	.034	29.453	< .001
	ATT	1.000	.036	27.660	< .001
	APT < > COG	.363	.026	14.206	< .001
	APT < > ATT	.149	.026	5.781	< .001
	COG < > ATT	.028	.026	1.113	.266

**p < .05

Phase III

Table 183. Persian Listening Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
11E	PT3	.999	.034	29.453	<.001
11F	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
11G	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	PT1	.999	.034	29.453	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > PT1	.109	.024	4.519	<.001
	PT2 < > PT1	-.015	.024	-.638	.524
11H	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	PT1	.999	.034	29.453	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT4	.999	.034	29.453	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > PT1	.109	.024	4.519	<.001
	PT3 < > PT4	.196	.024	8.011	<.001
	PT2 < > PT1	-.015	.024	-.638	.524
	PT2 < > PT4	-.039	.024	-1.640	.101
	PT1 < > PT4	.072	.024	2.991	.003**
11I	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	PT1	.999	.034	29.453	<.001
	PT4	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > PT1	.109	.024	4.519	<.001
	PT3 < > PT4	.196	.024	8.011	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT2 < > PT1	-.015	.024	-.638	.524
	PT2 < > PT4	-.039	.024	-1.640	.101
	PT2 < > WK	.038	.024	1.577	.115
	PT1 < > PT4	.072	.024	2.991	.003
	PT1 < > WK	.138	.024	5.691	<.001
	PT4 < > WK	.240	.025	9.712	<.001
11J	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	PT1	.999	.034	29.453	<.001
	PT4	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > PT1	.109	.024	4.519	<.001
	PT3 < > PT4	.196	.024	8.011	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001
	PT2 < > PT1	-.015	.024	-.638	.524
	PT2 < > PT4	-.039	.024	-1.640	.101
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT1 < > PT4	.072	.024	2.991	.003**

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT1 < > WK	.138	.024	5.691	<.001
	PT1 < > PC	.089	.024	3.694	<.001
	P4 < > PC	.247	.025	9.980	<.001
	WK < > PC	.441	.026	16.824	<.001
11K	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	PT1	.999	.034	29.453	<.001
	PT4	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	AR	.999	.034	29.453	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > PT1	.109	.024	4.519	<.001
	PT3 < > PT4	.196	.024	8.011	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001
	PT3 < > AR	.240	.025	9.714	<.001
	PT2 < > PT1	-.015	.024	-.638	.524
	PT2 < > PT4	-.039	.024	-1.640	.101
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT4 < > WK	.240	.025	9.712	<.001
	PT4 < > PC	.247	.025	9.980	<.001
	PT4 < > AR	.306	.025	12.207	<.001
	WK < > PC	.441	.026	16.824	<.001
	WK < > AR	.229	.025	9.316	<.001
	PC < > AR	.285	.025	11.415	<.001
11L	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	PT1	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	AR	.999	.034	29.453	<.001
	MK	.999	.034	29.453	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > PT1	.109	.024	4.519	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	***P***
	PT3 < > AR	.240	.025	9.714	<.001
	PT3 < > MK	.276	.025	11.094	<.001
	PT2 < > PT1	-.015	.024	-.638	.524
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT2 < > AR	.089	.024	3.677	<.001
	PT2 < > MK	.071	.024	2.950	.003**
	PT1 < > WK	.138	.024	5.691	<.001
	PT1 < > PC	.089	.024	3.694	<.001
	PT1 < > AR	.077	.024	3.204	.001**
	PT1 < > MK	.088	.024	3.663	<.001
	WK < > PC	.441	.026	16.824	<.001
	WK < > AR	.229	.025	9.316	<.001
	WK < > MK	.095	.024	3.925	<.001
	PC < > AR	.285	.025	11.415	<.001
	PC < > MK	.179	.024	7.349	<.001
	AR < > MK	.568	.028	20.590	< .001
11M	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	PT1	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	AR	.999	.034	29.453	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > PT1	.109	.024	4.519	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001
	PT3 < > AR	.240	.025	9.714	<.001
	PT2 < > PT1	-.015	.024	-.638	.524
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT2 < > AR	.089	.024	3.677	<.001
	PT1 < > WK	.138	.024	5.691	<.001
	PT1 < > PC	.089	.024	3.694	<.001
	PT1 < > AR	.077	.024	3.204	.001
	WK < > PC	.441	.026	16.824	<.001
	WK < > AR	.229	.025	9.316	<.001
	PC < > AR	.285	.025	11.415	<.001

**p < .05

Phase IV

Table 184. Persian Listening Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
11N	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	PT1	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	AR	.999	.034	29.453	<.001
	GPA	.996	.035	28.852	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > PT1	.109	.024	4.519	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001
	PT3 < > AR	.240	.025	9.714	<.001
	PT3 < > GPA	.276	.025	10.952	<.001
	PT2 < > PT1	-.015	.024	-.638	.524
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT2 < > AR	.089	.024	3.677	<.001
	PT2 < > GPA	.095	.024	3.876	<.001
	PT1 < > WK	.138	.024	5.691	<.001
	PT1 < > PC	.089	.024	3.694	<.001
	PT1 < > AR	.077	.024	3.204	.001
	PT1 < > GPA	.185	.025	7.482	< .001
	WK < > PC	.441	.026	16.824	<.001
	WK < > AR	.229	.025	9.316	<.001
	WK < > GPA	.155	.025	6.289	<.001
	PC < > AR	.285	.025	11.415	<.001
	PC < > GPA	.132	.025	5.366	<.001
	AR < > GPA	.146	.025	5.942	<.001
11O	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	AR	.999	.034	29.453	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	GPA	.997	.035	28.846	<.001
	AGE	1.000	.036	27.614	<.001
	PT3 < > PT2	173	.024	.7.096	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001
	PT3 < > AR	.240	.025	9.714	<.001
	PT3 < > GPA	.276	.025	10.925	<.001
	PT3 < > AGE	.011	.025	.431	.666
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT2 < > AR	.089	.024	3.677	<.001
	PT2 < > GPA	.095	.024	3.868	<.001
	PT2 < > AGE	.059	.025	2.308	.021
	WK < > PC	.441	.026	16.824	<.001
	WK < > AR	.229	.025	9.316	<.001
	WK < > GPA	.155	.025	6.302	<.001
	WK < > AGE	.345	.027	12.912	<.001
	PC < > AR	.285	.025	11.415	<.001
	PC < > GPA	.131	.025	5.350	<.001
	PC < > AGE	.174	.026	6.775	<.001
	AR < > GPA	.146	.025	5.937	<.001
	AR < > AGE	.130	.026	5.093	<.001
	GPA < > AGE	-.045	.026	-1.729	.084
11P	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	AR	.999	.034	29.453	<.001
	GPA	.998	.035	28.848	<.001
	AGE	1.000	.036	27.632	<.001
	EDUC	.998	.036	27.632	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001
	PT3 < > AR	.240	.025	9.714	<.001
	PT3 < > GPA	.276	.025	10.939	<.001
	PT3 < > AGE	.012	.025	.459	.646
	PT3 < > EDUC	.025	.025	1.001	.317

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT2 < > AR	.089	.024	3.677	<.001
	PT2 < > GPA	.094	.024	3.858	<.001
	PT2 < > AGE	.059	.025	2.306	.021
	PT2 < > EDUC	-.012	.025	-.467	.641
	WK < > PC	.441	.026	16.824	<.001
	WK < > AR	.229	.025	9.316	<.001
	WK < > GPA	.155	.025	6.303	<.001
	WK < > AGE	.346	.027	.346	<.001
	WK < > EDUC	.303	.026	11.455	<.001
	PC < > AR	.285	.025	11.415	<.001
	PC < > GPA	.131	.025	5.355	<.001
	PC < > AGE	.173	.026	6.715	<.001
	PC < > EDUC	.142	.026	5.535	<.001
	AR < > GPA	.146	.025	5.931	<.001
	AR < > AGE	.130	.026	5.080	<.001
	AR < > EDUC	.094	.026	3.703	<.001
	GPA < > AGE	-.046	.026	-1.779	.075
	GPA < > EDUC	.041	.026	1.603	.109
11Q	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	AR	.999	.034	29.453	<.001
	GPA	.997	.035	28.846	<.001
	AGE	1.000	.036	27.617	<.001
	TRN_HRS	1.001	.045	22.478	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001
	PT3 < > AR	.240	.025	9.714	<.001
	PT3 < > GPA	.276	.025	10.928	<.001
	PT3 < > AGE	.011	.025	.429	.668
	PT3 < > TRN_HRS	-.046	.031	-1.456	.145
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT2 < > AR	.089	.024	3.677	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT2 < > GPA	.095	.024	3.872	<.001
	PT2 < > AGE	.059	.025	2.333	.020
	PT2 < > TRN_HRS	-.046	.031	-1.467	.142
	WK < > PC	.441	.026	16.824	<.001
	WK < > AR	.229	.025	9.316	<.001
	WK < > GPA	.155	.025	6.302	<.001
	WK < > AGE	.345	.027	12.926	<.001
	WK < > TRN_HRS	-.004	.031	-.133	.894
	PC < > AR	.285	.025	11.415	<.001
	PC < > GPA	.131	.025	5.351	<.001
	PC < > AGE	.174	.026	6.755	<.001
	PC < > TRN_HRS	-.017	.031	-.556	.578
	AR < > GPA	.146	.025	5.934	<.001
	AR < > AGE	.129	.026	5.060	<.001
	AR < > TRN_HRS	-.119	.031	-3.781	<.001
	GPA < > AGE	-.046	.026	-1.772	.076
	GPA< > TRN_HRS	-.009	.032	-.277	.782
	AGE < > TRN_HRS	.097	.033	2.977	.003
11R	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	AR	.999	.034	29.453	<.001
	GPA	.997	.035	28.849	<.001
	AGE	1.000	.036	27.614	<.001
	BILLET	.245	.010	25.567	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001
	PT3 < > AR	.240	.025	9.714	<.001
	PT3 < > GPA	.276	.025	10.947	<.001
	PT3 < > AGE	.011	.025	.440	.660
	PT3 < > BILLET	-.018	.014	-1.285	.199
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT2 < > AR	.089	.024	3.677	<.001
	PT2 < > GPA	.095	.024	3.872	<.001
	PT2 < > AGE	.059	.025	2.319	.020

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT2 < > BILLET	-.023	.014	-1.682	.092
	WK < > PC	.441	.026	16.824	<.001
	WK < > AR	.229	.025	9.316	<.001
	WK < > GPA	.155	.025	6.291	<.001
	WK < > AGE	.345	.027	12.912	<.001
	WK < > BILLET	.007	.014	.534	.594
	PC < > AR	.285	.025	11.415	<.001
	PC < > GPA	.131	.025	5.356	<.001
	PC < > AGE	.174	.026	6.776	<.001
	PC < > BILLET	.004	.014	.313	.754
	AR < > GPA	.146	.025	5.938	<.001
	AR < > AGE	.131	.026	5.106	<.001
	AR < > BILLET	-.052	.014	-3.804	<.001
	GPA < > AGE	-.044	.026	-1.721	.085
	GPA< > BILLET	-.035	.014	-2.517	.012
	AGE < > BILLET	.009	.014	.636	.525
11S	PT3	.999	.034	29.453	<.001
	PT2	.999	.034	29.453	<.001
	WK	.999	.034	29.453	<.001
	PC	.999	.034	29.453	<.001
	AR	.999	.034	29.453	<.001
	GPA	.997	.035	28.847	<.001
	AGE	1.000	.036	27.614	<.001
	SEX	.215	.007	29.453	<.001
	PT3 < > PT2	.173	.024	7.096	<.001
	PT3 < > WK	.211	.025	8.622	<.001
	PT3 < > PC	.160	.024	6.600	<.001
	PT3 < > AR	.240	.025	9.714	<.001
	PT3 < > GPA	.275	.025	10.916	<.001
	PT3 < > AGE	.011	.025	.425	.671
	PT3 < > SEX	.003	.011	.274	.784
	PT2 < > WK	.038	.024	1.577	.115
	PT2 < > PC	.034	.024	1.415	.157
	PT2 < > AR	.089	.024	3.677	<.001
	PT2 < > GPA	.095	.024	3.878	<.001
	PT2 < > AGE	.059	.025	2.312	.021
	PT2 < > SEX	-.010	.011	-.893	.372
	WK < > PC	.441	.026	16.824	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	WK < > AR	.229	.025	9.316	<.001
	WK < > GPA	.155	.025	6.293	<.001
	WK < > AGE	.345	.027	12.910	<.001
	WK < > SEX	.053	.011	4.745	<.001
	PC < > AR	.285	.025	11.415	<.001
	PC < > GPA	.132	.025	5.365	<.001
	PC < > AGE	.174	.026	6.773	<.001
	PC < > SEX	.058	.011	5.168	<.001
	AR < > GPA	.147	.025	5.966	<.001
	AR < > AGE	.130	.026	5.095	<.001
	AR < > SEX	.096	.011	8.487	<.001
	GPA < > AGE	-.044	.026	-1.723	.085
	GPA < > SEX	-.004	.011	-.377	.706
	AGE < > SEX	.031	.012	2.619	.009

**p < .05

Persian Reading Variances and Covariances

Phase II

Table 185. Persian Reading Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
12B	APT	.999	.044	22.694	<.001
12C	APT	.999	.044	22.694	<.001
	COG	.999	.044	22.694	<.001
	APT < > COG	.313	.033	9.607	<.001
12D	APT	.999	.044	22.694	<.001
	COG	.999	.044	22.694	<.001
	ATT	.999	.048	20.809	<.001
	APT < > COG	.313	.033	9.607	<.001
	APT < > ATT	.063	.034	1.846	.065
	COG < > ATT	.015	.034	.437	.662

**p < .05

Phase III

Table 186. Persian Reading Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
12E	PT3	.999	.044	22.694	<.001
12F	PT3	.999	.044	22.694	<.001
	PT2	.999	.044	22.694	<.001
	PT3 < > PT2	.112	.031	3.589	<.001
12G	PT3	.999	.044	22.694	<.001
	PT1	.999	.044	22.694	<.001
	PT3 < > PT1	.055	.031	1.770	.077
12H	PT3	.999	.044	22.694	<.001
	PT1	.999	.044	22.694	<.001
	PT4	.999	.044	22.694	<.001
	PT3 < > PT1	.055	.031	1.770	.077
	PT3 < > PT4	.083	.031	2.645	.008
	PT1 < > PT4	.027	.031	.861	.389
12I	PT3	.999	.044	22.694	<.001
	PT1	.999	.044	22.694	<.001
	PT4	.999	.044	22.694	<.001
	WK	.999	.044	22.694	<.001
	PT3 < > PT1	.055	.031	1.770	.077
	PT3 < > PT4	.083	.031	2.645	.008**
	PT3 < > WK	.165	.032	5.225	<.001
	PT1 < > PT4	.027	.031	.861	.389
	PT1 < > WK	.101	.031	3.216	.001**
	PT4 < > WK	.192	.032	6.055	<.001
12J	PT3	.999	.044	22.694	<.001
	PT1	.999	.044	22.694	<.001
	PT4	.999	.044	22.694	<.001
	WK	.999	.044	22.694	<.001
	PC	.999	.044	22.694	<.001
	PT3 < > PT1	.055	.031	1.770	.077
	PT3 < > PT4	.083	.031	2.645	.008
	PT3 < > WK	.165	.032	5.225	<.001
	PT3 < > PC	.118	.031	3.754	<.001
	PT1 < > PT4	.027	.031	.861	.389
	PT1 < > WK	.101	.031	3.216	.001
	PT1 < > PC	.059	.031	1.906	.057
	P4 < > WK	.192	.032	6.055	<.001
	P4 < > PC	.222	.032	6.968	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	WK < > PC	.462	.034	13.464	<.001
12K	PT3	.999	.044	22.694	<.001
	PT1	.999	.044	22.694	<.001
	PT4	.999	.044	22.694	<.001
	WK	.999	.044	22.694	<.001
	PC	.999	.044	22.694	<.001
	AR	.999	.044	22.694	<.001
	PT3 < > PT1	.055	.031	1.770	.077
	PT3 < > PT4	.083	.031	2.645	.008
	PT3 < > WK	.165	.032	5.225	<.001
	PT3 < > PC	.118	.031	3.754	<.001
	PT3 < > AR	.196	.032	6.171	<.001
	PT4 < > WK	.192	.032	6.055	<.001
	PT4 < > PC	.222	.032	6.968	<.001
	PT4 < > AR	.299	.032	9.198	<.001
	WK < > PC	.462	.034	13.464	<.001
	WK < > AR	.202	.032	6.372	<.001
	PC < > AR	.260	.032	8.087	<.001
12L	PT3	.999	.044	22.694	<.001
	PT1	.999	.044	22.694	<.001
	PT4	.999	.044	22.694	<.001
	WK	.999	.044	22.694	<.001
	PC	.999	.044	22.694	<.001
	MK	.999	.044	22.694	<.001
	PT3 < > PT1	.055	.031	1.770	.077
	PT3 < > PT4	.083	.031	2.645	.008
	PT3 < > WK	.165	.032	5.225	<.001
	PT3 < > PC	.118	.031	3.754	<.001
	PT3 < > MK	.250	.032	7.793	<.001
	PT1 < > PT4	.027	.031	.861	.389
	PT1 < > WK	.101	.031	3.216	.001
	PT1 < > PC	.059	.031	1.906	.057
	PT1 < > MK	.069	.031	2.203	.028
	PT4 < > WK	.192	.032	6.055	<.001
	PT4 < > PC	.222	.032	6.968	<.001
	PT4 < > MK	.241	.032	7.526	<.001
	WK < > PC	.462	.034	13.464	<.001
	WK < > MK	.039	.031	1.239	.215

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PC < > MK	.145	.031	4.613	<.001
12M	PT3	.999	.044	22.694	<.001
	PT1	.999	.044	22.694	<.001
	WK	.999	.044	22.694	<.001
	PC	.999	.044	22.694	<.001
	MK	.999	.044	22.694	<.001
	ATT	.999	.048	20.809	< .001
	PT3 < > PT1	.055	.031	1.770	<.001
	PT3 < > WK	.165	.032	5.225	<.001
	PT3 < > PC	.118	.031	3.754	<.001
	PT3 < > MK	.250	.032	7.793	<.001
	PT3 < > ATT	.082	.034	2.411	.016
	PT1 < > WK	.101	.031	3.216	.001
	PT1 < > PC	.059	.031	1.906	.057
	PT1 < > MK	.069	.031	2.203	.028
	PT1 < > ATT	.061	.034	1.803	.071
	WK < > PC	.462	.034	13.464	<.001
	WK < > MK	.039	.031	1.239	.215
	WK < > ATT	.020	.034	.600	.549
	PC < > MK	.145	.031	4.613	<.001
	PC < > ATT	.009	.034	.264	.792
	MK < > ATT	.007	.034	.210	.833

**p < .05

Phase IV

Table 187. Persian Reading Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
12N	PT3	.999	.044	22.694	<. 001
	PT1	.999	.044	22.694	< .001
	WK	.999	.044	22.694	< .001
	PC	.999	.044	22.694	< .001
	MK	.999	.044	22.694	< .001
	ATT	.999	.048	20.809	< .001
	GPA	.997	.045	22.228	< .001
	PT3 < > PT1	.055	.031	1.770	.077
	PT3 < > WK	.165	.032	5.225	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT3 < > PC	.118	.031	3.754	< .001
	PT3 < > MK	.250	.032	7.793	< .001
	PT3 < > ATT	.082	.034	2.411	.016**
	PT3 < > GPA	.269	.033	8.234	< .001
	PT1 < > WK	.101	.031	3.216	.001**
	PT1 < > PC	.059	.031	1.906	.057
	PT1 < > MK	.069	.031	2.203	.028**
	PT1 < > ATT	.061	.034	1.800	.072
	PT1 < > GPA	.148	.032	4.643	< .001
	WK < > PC	.462	.034	13.464	< .001
	WK < > MK	.039	.031	1.239	.215
	WK < > ATT	.020	.034	.594	.553
	WK < > GPA	.146	.032	4.564	< .001
	PC < > MK	.145	.031	4.613	< .001
	PC < > ATT	.009	.034	.259	.795
	PC < > GPA	.144	.032	4.508	<.001
	MK < > ATT	.007	.034	.212	.832
	MK < > GPA	.157	.032	4.923	<.001
	ATT < > GPA	.081	.035	2.335	.020**
12O	WK	.999	.044	22.694	<.001
	PC	.999	.044	22.694	<.001
	MK	.999	.044	22.694	<.001
	ATT	.999	.048	20.809	< .001
	GPA	.997	.045	22.215	<.001
	AGE	.998	.048	20.765	<.001
	WK < > PC	.462	.034	13.464	<.001
	WK < > MK	.039	.031	1.239	.215
	WK < > ATT	.019	.034	.559	.576
	WK < > GPA	.146	.032	4.587	<.001
	WK < > AGE	.212	.034	6.152	<.001
	PC < > MK	.145	.031	4.613	<.001
	PC < > ATT	.009	.034	.255	.799
	PC < > GPA	.145	.032	4.549	<.001
	PC < > AGE	.159	.034	4.642	<.001
	MK < > ATT	.005	.034	.142	.887
	MK < > GPA	.157	.032	4.923	<.001
	MK < > AGE	.013	.034	.398	.691
	ATT < > GPA	.079	.035	2.295	.022**

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	ATT < > AGE	.030	.034	.869	.385
	GPA < > AGE	-.012	.034	-.343	.732
12P	WK	.999	.044	22.694	< .001
	PC	.999	.044	22.694	< .001
	MK	.999	.044	22.694	< .001
	ATT	.999	.048	20.809	< .001
	GPA	.997	.045	22.215	< .001
	EDUC	.997	.048	20.779	< .001
	WK < > PC	.462	.034	13.464	< .001
	WK < > MK	.039	.031	1.239	.215
	WK < > ATT	.019	.034	.560	.576
	WK < > GPA	.146	.032	4.580	< .001
	WK < > EDUC	.305	.035	8.711	< .001
	PC < > MK	.145	.031	4.613	< .001
	PC < > ATT	.009	.034	.256	.798
	PC < > GPA	.145	.032	4.541	< .001
	PC < > EDUC	.121	.034	3.577	< .001
	MK < > ATT	.005	.034	.142	.887
	MK < > GPA	.157	.032	4.913	< .001
	MK < > EDUC	-.004	.034	-.118	.906
	ATT < > GPA	.079	.035	2.289	.022**
	ATT < > EDUC	.039	.034	1.133	.257
	GPA < > EDUC	.037	.034	1.083	.279
12Q	WK	.999	.044	22.694	< .001
	PC	.999	.044	22.694	< .001
	MK	.999	.044	22.694	< .001
	ATT	.998	.048	20.809	< .001
	GPA	.997	.045	22.215	< .001
	EDUC	.997	.048	20.779	< .001
	TRN_HRS	.998	.058	17.191	< .001
	WK < > PC	.462	.034	13.464	< .001
	WK < > MK	.039	.031	1.239	.215
	WK < > ATT	.019	.034	.553	.580
	WK < > GPA	.146	.032	4.580	< .001
	WK < > EDUC	.305	.035	8.710	< .001
	WK < > TRN_HRS	-.005	.041	-.124	.901
	PC < > MK	.145	.031	4.613	< .001
	PC < > ATT	.008	.034	.240	.810

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PC < > GPA	.145	.032	4.540	< .001
	PC < > EDUC	.121	.034	3.569	< .001
	PC < > TRN_HRS	-.028	.041	-.677	.499
	MK < > ATT	.004	.034	.125	.900
	MK < > GPA	.157	.032	4.913	< .001
	MK < > EDUC	-.004	.034	-.132	.895
	MK < > TRN_HRS	-.057	.041	-1.383	.167
	ATT < > GPA	.078	.035	2.259	.024
	ATT < > EDUC	.038	.034	1.123	.261
	ATT < > TRN_HRS	.080	.044	1.844	.065
	GPA < > EDUC	.036	.034	1.065	.287
	GPA < > TRN_HRS	.013	.042	.316	.752
	EDUC < > TRN_HRS	.053	.043	1.228	.220
12R	WK	.999	.044	22.694	< .001
	PC	.999	.044	22.694	< .001
	MK	.999	.044	22.694	< .001
	ATT	.999	.048	20.810	< .001
	GPA	.997	.045	22.218	< .001
	EDUC	.998	.048	20.780	< .001
	BILLET	.246	.013	19.523	< .001
	WK < > PC	.462	.034	13.464	< .001
	WK < > MK	.039	.031	1.239	.215
	WK < > ATT	.020	.034	.592	.554
	WK < > GPA	.146	.032	4.587	< .001
	WK < > EDUC	.306	.035	8.727	< .001
	WK < > BILLET	.015	.018	.857	.392
	PC < > MK	.145	.031	4.613	< .001
	PC < > ATT	.145	.031	4.613	.145
	PC < > GPA	.146	.032	4.587	< .001
	PC < > EDUC	.122	.034	3.585	< .001
	PC < > BILLET	.017	.018	.942	.346
	MK < > ATT	.007	.034	.192	.848
	MK < > GPA	.146	.032	4.587	< .001
	MK < > EDUC	-.003	.034	-.100	.920
	MK < > BILLET	.017	.018	.942	.346
	ATT < > GPA	.146	.032	4.587	.146
	ATT < > EDUC	-.003	.034	-.100	.920
	ATT < > BILLET	.059	.019	3.046	.002**

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	GPA < > EDUC	.037	.034	1.090	.276
	GPA< > BILLET	-.040	.018	-2.202	.028**
	EDUC < > BILLET	.038	.019	1.989	.047**
12S	WK	.999	.044	22.694	< .001
	PC	.999	.044	22.694	< .001
	MK	.999	.044	22.694	< .001
	ATT	.998	.048	20.810	< .001
	GPA	.997	.045	22.219	< .001
	EDUC	.998	.048	20.782	< .001
	BILLET	.246	.013	19.525	< .001
	SEX	.222	.010	22.694	< .001
	WK < > PC	.462	.034	13.464	< .001
	WK < > MK	.039	.031	1.239	.215
	WK < > ATT	.145	.031	4.613	.145
	WK < > GPA	.145	.031	4.613	< .001
	WK < > EDUC	.145	.031	4.613	< .001
	WK < > BILLET	.145	.031	4.613	.145
	WK < > SEX	.145	.031	4.613	< .001
	PC < > MK	.145	.031	4.613	< .001
	PC < > ATT	.145	.031	4.613	.145
	PC < > GPA	.145	.031	4.613	< .001
	PC < > EDUC	.145	.031	4.613	< .001
	PC < > BILLET	.017	.018	.966	.334
	PC < > SEX				< .001
	MK < > ATT	.006	.034	.183	.855
	MK < > GPA	.145	.031	4.613	< .001
	MK < > EDUC	-.003	.034	-.102	.919
	MK < > BILLET	-.029	.018	-1.642	.101
	MK < > SEX	.045	.015	3.023	.003**
	ATT < > GPA	.080	.034	2.329	.020**
	ATT < > EDUC	.039	.034	1.143	.253
	ATT < > BILLET	.058	.019	2.969	.003**
	ATT < > SEX	-.028	.016	-1.770	.077
	GPA < > EDUC	.038	.034	1.097	.273
	GPA < > BILLET	-.041	.018	-2.278	.023**
	GPA < > SEX	-.001	.015	-.071	.943
	EDUC < > BILLET	.037	.019	1.939	.053
	EDUC < > SEX	-.020	.016	-1.269	.205

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	BILLET < > SEX	-.025	.008	-2.953	.003**

**p < .05

Russian Listening Variances and Covariances

Phase II

Table 188. Russian Listening Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
13B	APT	.999	.053	18.708	< .001
13C	APT	.999	.053	18.708	< .001
	COG	.999	.053	18.708	< .001
	APT < > COG	.420	.041	10.264	< .001
13D	APT	.999	.053	18.708	< .001
	COG	.999	.053	18.708	< .001
	ATT	1.000	.055	18.167	< .001
	APT < > COG	.420	.041	10.264	< .001
	APT < > ATT	.164	.039	4.158	< .001
	COG < > ATT	.020	.039	.520	.603

**p < .05

Phase III

Table 189. Russian Listening Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
13E	PT3	.999	.053	18.708	< .001
13F	PT3	.999	.053	18.708	< .001
	PT2	.999	.053	18.708	< .001
	PT3 < > PT2	.239	.039	6.156	< .001
13G	PT3	.999	.053	18.708	< .001
	PT1	.999	.053	18.708	< .001
	PT3 < > PT1	.180	.038	4.690	< .001
13H	PT3	.999	.053	18.708	< .001
	PT4	.999	.053	18.708	< .001
	PT3 < > PT4	.325	.040	8.183	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
13I	PT3	.999	.053	18.708	< .001
	PT4	.999	.053	18.708	< .001
	WK	.999	.053	18.708	< .001
	PT3 < > PT4	.325	.040	8.183	< .001
	PT3 < > WK	.257	.039	6.594	< .001
	PT4 < > WK	.289	.039	7.358	< .001
13J	PT3	.999	.053	18.708	< .001
	WK	.999	.053	18.708	< .001
	PC	.999	.053	18.708	< .001
	PT3 < > WK	.257	.039	6.594	< .001
	PT3 < > PC	.211	.039	5.471	< .001
	WK < > PC	.398	.041	9.799	< .001
13K	PT3	.999	.053	18.708	< .001
	WK	.999	.053	18.708	< .001
	PC	.999	.053	18.708	< .001
	AR	.999	.053	18.708	< .001
	PT3 < > WK	.257	.039	6.594	< .001
	PT3 < > PC	.211	.039	5.471	< .001
	PT3 < > AR	.300	.039	7.615	< .001
	WK < > PC	.398	.041	9.799	< .001
	WK < > AR	.263	.039	6.731	< .001
	PC < > AR	.308	.039	7.799	< .001
13L	WK	.999	.053	18.708	< .001
	PC	.999	.053	18.708	< .001
	AR	.999	.053	18.708	< .001
	MK	.999	.053	18.708	< .001
	WK < > PC	.398	.041	9.799	< .001
	WK < > AR	.263	.039	6.731	< .001
	WK < > MK	.171	.038	4.457	< .001
	PC < > AR	.308	.039	7.799	< .001
	PC < > MK	.219	.039	5.659	< .001
	AR < > MK	.565	.043	13.037	< .001
13M	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	AR	.999	.053	18.708	<.001
	ATT	.999	.055	18.166	<.001
	WK < > PC	.398	.041	9.799	<.001
	WK < > AR	.263	.039	6.731	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	WK < > ATT	-.030	.039	-.773	.439
	PC < > AR	.308	.039	7.799	<.001
	PC < > ATT	.038	.039	.966	.334
	AR < > ATT	.010	.039	.261	.794

**p < .05

Phase IV

Table 190. Russian Listening Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
13N	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	AR	.999	.053	18.708	<.001
	ATT	.999	.055	18.166	<.001
	GPA	.996	.054	18.330	<.001
	WK < > PC	.398	.041	9.799	<.001
	WK < > AR	.263	.039	6.731	<.001
	WK < > ATT	-.031	.039	-.786	.432
	WK < > GPA	.166	.039	4.287	<.001
	PC < > AR	.308	.039	7.799	<.001
	PC < > ATT	.038	.039	.984	.325
	PC < > GPA	.108	.039	2.817	.005**
	AR < > ATT	.010	.039	.256	.798
	AR < > GPA	.198	.039	5.085	<.001
	ATT < > GPA	.071	.039	1.811	.070
13O	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.166	<.001
	GPA	.996	.054	18.328	<.001
	AGE	1.004	.055	18.135	<.001
	WK < > PC	.398	.041	9.799	<.001
	WK < > ATT	-.030	.039	-.784	.433
	WK < > GPA	.166	.039	4.277	<.001
	WK < > AGE	.351	.041	8.545	<.001
	PC < > ATT	.038	.039	.987	.324
	PC < > GPA	.109	.039	2.834	.005**

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PC < > AGE	.172	.039	4.372	<.001
	ATT < > GPA	.070	.039	1.775	.076
	ATT < > AGE	-.081	.039	-2.065	.039**
	GPA < > AGE	-.039	.039	-.983	.326
13P	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.166	<.001
	GPA	.996	.054	18.328	<.001
	EDUC	1.002	.055	18.144	<.001
	WK < > PC	.398	.041	9.799	<.001
	WK < > ATT	-.030	.039	-.784	.433
	WK < > GPA	.167	.039	4.295	<.001
	WK < > EDUC	.303	.041	7.470	<.001
	PC < > ATT	.038	.039	.987	.324
	PC < > GPA	.108	.039	2.816	.005**
	PC < > EDUC	.158	.039	4.021	<.001
	ATT < > GPA	.070	.039	1.773	.076
	ATT < > EDUC	-.089	.039	-2.266	.023**
	GPA < > EDUC	.052	.039	1.326	.185
13Q	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.166	<.001
	GPA	.996	.054	18.329	<.001
	EDUC	1.002	.055	18.145	<.001
	TRN_HRS	1.001	.069	14.458	<.001
	WK < > PC	.398	.041	9.799	<.001
	WK < > ATT	-.030	.039	-.781	.435
	WK < > GPA	.167	.039	4.293	<.001
	WK < > EDUC	.303	.041	7.473	<.001
	WK < > TRN_HRS	.008	.049	.162	.871
	PC < > ATT	.038	.039	.982	.326
	PC < > GPA	.108	.039	2.815	.005**
	PC < > EDUC	.158	.039	4.016	<.001
	PC < > TRN_HRS	.003	.049	.064	.949
	ATT < > GPA	.069	.039	1.761	.078
	ATT < > EDUC	-.089	.039	-2.270	.023**
	ATT < > TRN_HRS	.040	.050	.803	.422
	GPA < > EDUC	.052	.039	1.311	.190

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	GPA< > TRN_HRS	-.028	.049	-.561	.575
	EDUC < > TRN_HRS	.046	.050	.916	.360
13R	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.166	<.001
	GPA	.996	.054	18.331	<.001
	EDUC	1.002	.055	18.145	<.001
	BILLET	.242	.015	16.494	<.001
	WK < > PC	.398	.041	9.799	<.001
	WK < > ATT	-.030	.039	-.783	.433
	WK < > GPA	.165	.039	4.266	<.001
	WK < > EDUC	.303	.041	7.468	<.001
	WK < > BILLET	.003	.021	.166	.868
	PC < > ATT	.038	.039	.986	.324
	PC < > GPA	.108	.039	2.796	.005**
	PC < > EDUC	.158	.039	4.020	<.001
	PC < > BILLET	-.005	.021	-.241	.810
	ATT < > GPA	.071	.039	1.802	.072
	ATT < > EDUC	-.089	.039	-2.264	.024**
	ATT < > BILLET	.013	.022	.589	.556
	GPA < > EDUC	.051	.039	1.308	.191
	GPA< > BILLET	-.023	.021	-1.078	.281
	EDUC < > BILLET	-.018	.022	-.849	.396
13S	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.166	<.001
	GPA	.995	.054	18.329	<.001
	EDUC	1.002	.055	18.145	<.001
	SEX	.202	.011	18.708	<.001
	WK < > PC	.398	.041	9.799	<.001
	WK < > ATT	-.030	.039	-.780	.435
	WK < > GPA	.167	.039	4.307	<.001
	WK < > EDUC	.302	.041	7.466	<.001
	WK < > SEX	.035	.017	2.076	.038**
	PC < > ATT	.038	.039	.987	.324
	PC < > GPA	.109	.038	2.827	.005**
	PC < > EDUC	.159	.039	4.031	<.001
	PC < > SEX	.047	.017	2.775	.006**

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	ATT < > GPA	.069	.039	1.761	.078
	ATT < > EDUC	-.089	.039	-2.267	.023**
	ATT < > SEX	.012	.017	.671	.502
	GPA < > EDUC	.053	.039	1.346	.178
	GPA < > SEX	-.015	.017	-.898	.369
	EDUC < > SEX	-.031	.018	-1.765	.078

**p < .05

Russian Reading Variances and Covariances

Phase II

Table 191. Russian Reading Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
14B	APT	.999	.053	18.708	<.001
14C	APT	.999	.053	18.708	<.001
	COG	.999	.053	18.708	<.001
	APT < > COG	.422	.041	10.292	<.001
14D	APT	.999	.053	18.708	<.001
	COG	.999	.053	18.708	<.001
	ATT	.999	.055	18.180	<.001
	APT < > COG	.422	.041	10.292	<.001
	APT < > ATT	.163	.039	4.137	< .001
	COG < > ATT	.019	.039	.501	.617

**p < .05

Phase III

Table 192. Russian Reading Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
14E	PT3	.999	.053	18.708	<.001
14F	PT3	.999	.053	18.708	<.001
	PT2	.999	.053	18.708	<.001
	PT3 < > PT2	.242	.039	6.235	<.001
14G	PT3	.999	.053	18.708	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT1	.999	.053	18.708	<.001
	PT3 < > PT1	.180	.038	4.687	< .001
14H	PT3	.999	.053	18.708	<.001
	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	PT3 < > PT1	.180	.038	4.687	< .001
	PT3 < > PT4	.321	.040	8.088	< .001
	PT1 < > PT4	.125	.038	3.286	.001**
14I	PT3	.999	.053	18.708	<.001
	PT1	.999	.053	18.708	< .001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PT3 < > PT1	.180	.038	4.687	.077
	PT3 < > PT4	.321	.040	8.088	<.001
	PT3 < > WK	.257	.039	6.604	<.001
	PT1 < > PT4	.125	.038	3.286	.001**
	PT1 < > WK	.187	.038	4.873	<.001
	PT4 < > WK	.290	.039	7.379	<.001
14J	PT3	.999	.053	18.708	<.001
	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	PT3 < > PT1	.180	.038	4.687	<.001
	PT3 < > PT4	.321	.040	8.088	<.001
	PT3 < > WK	.257	.039	6.604	<.001
	PT3 < > PC	.210	.039	5.456	<.001
	PT1 < > PT4	.125	.038	3.286	.001**
	PT1 < > WK	.187	.038	4.873	<.001
	PT1 < > PC	.127	.038	3.348	<.001
	P4 < > WK	.290	.039	7.379	<.001
	P4 < > PC	.266	.039	6.803	< .001
	WK < > PC	.399	.041	9.810	<.001
14K	PT3	.999	.053	18.708	<.001
	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	AR	.999	.053	18.708	<.001
	PT3 < > PT1	.180	.038	4.687	<.001
	PT3 < > PT4	.321	.040	8.088	<.001
	PT3 < > WK	.257	.039	6.604	<.001
	PT3 < > PC	.210	.039	5.456	<.001
	PT3 < > AR	.301	.039	7.639	<.001
	PT4 < > WK	.290	.039	7.379	<.001
	PT4 < > PC	.266	.039	6.803	<.001
	PT4 < > AR	.309	.040	7.825	<.001
	WK < > PC	.399	.041	9.810	<.001
	WK < > AR	.259	.039	6.653	<.001
	PC < > AR	.308	.039	7.796	<.001
14L	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	AR	.999	.053	18.708	<.001
	MK	.999	.053	18.708	<.001
	PT1 < > PT4	.125	.038	3.286	.001**
	PT1 < > WK	.187	.038	4.873	<.001
	PT1 < > PC	.127	.038	3.348	<.001
	PT1 < > AR	.135	.038	3.542	<.001
	PT1 < > MK	.112	.038	2.956	.003**
	PT4 < > WK	.290	.039	7.379	<.001
	PT4 < > PC	.266	.039	6.803	<.001
	PT4 < > AR	.309	.040	7.825	<.001
	PT4 < > MK	.269	.039	6.889	<.001
	WK < > PC	.399	.041	9.810	<.001
	WK < > AR	.259	.039	6.653	<.001
	WK < > MK	.166	.038	4.344	<.001
	PC < > AR	.308	.039	7.796	<.001
	PC < > MK	.216	.039	5.595	<.001
	AR < > MK	.564	.043	13.013	<.001
14M	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	AR	.999	.053	18.708	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	ATT	.999	.055	18.180	< .001
	PT1 < > PT4	.125	.038	3.286	.001
	PT1 < > WK	.187	.038	4.873	<.001
	PT1 < > PC	.127	.038	3.348	<.001
	PT1 < > AR	.135	.038	3.542	<.001
	PT1 < > ATT	.046	.039	1.197	.231
	PT4 < > WK	.290	.039	7.379	<.001
	PT4 < > PC	.266	.039	6.803	<.001
	PT4 < > AR	.309	.040	7.825	<.001
	PT4 < > ATT	.096	.039	2.457	.014
	WK < > PC	.399	.041	9.810	<.001
	WK < > AR	.259	.039	6.653	<.001
	WK < > ATT	-.026	.039	-.670	.503
	PC < > AR	.308	.039	7.796	<.001
	PC < > ATT	.039	.039	1.005	.315
	AR < > ATT	.012	.039	.305	<.001

**p < .05

Phase IV

Table 193. Russian Reading Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
14N	PT1	.999	.053	18.708	< .001
	PT4	.999	.053	18.708	< .001
	WK	.999	.053	18.708	< .001
	PC	.999	.053	18.708	< .001
	AR	.999	.053	18.708	< .001
	ATT	.999	.055	18.180	< .001
	GPA	1.003	.055	18.333	< .001
	PT1 < > PT4	.125	.038	3.286	.001**
	PT1 < > WK	.187	.038	4.873	< .001
	PT1 < > PC	.127	.038	3.348	< .001
	PT1 < > AR	.135	.038	3.542	< .001
	PT1 < > ATT	.046	.039	1.195	.232
	PT1 < > GPA	.233	.039	5.910	< .001
	PT4 < > WK	.290	.039	7.379	< .001
	PT4 < > PC	.266	.039	6.803	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT4 < > AR	.309	.040	7.825	< .001
	PT4 < > ATT	.096	.039	2.467	.014
	PT4 < > GPA	.120	.039	3.109	.002
	WK < > PC	.399	.041	9.810	< .001
	WK < > AR	.259	.039	6.653	< .001
	WK < > ATT	-.026	.039	-.680	.497
	WK < > GPA	.174	.039	4.469	< .001
	PC < > AR	.308	.039	7.796	< .001
	PC < > ATT	.040	.039	1.020	.308
	PC < > GPA	.116	.039	3.002	.003
	AR < > ATT	.012	.039	.309	.757
	AR < > GPA	.199	.039	5.094	< .001
	ATT < > GPA	.069	.039	1.743	.081
14O	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.180	<.001
	GPA	1.004	.055	18.335	<.001
	AGE	.999	.053	18.708	<.001
	PT1 < > PT4	.125	.038	3.286	.001
	PT1 < > WK	.187	.038	4.873	<.001
	PT1 < > PC	.127	.038	3.348	<.001
	PT1 < > ATT	.046	.039	1.183	.237
	PT1 < > GPA	.232	.039	5.893	<.001
	PT1 < > AGE	.278	.040	6.913	<.001
	PT4 < > WK	.290	.039	7.379	<.001
	PT4 < > PC	.266	.039	6.803	<.001
	PT4 < > ATT	.096	.039	2.473	.013
	PT4 < > GPA	.120	.039	3.111	.002
	PT4 < > AGE	.165	.039	4.192	<.001
	WK < > PC	.399	.041	9.810	<.001
	WK < > ATT	-.026	.039	-.677	.498
	WK < > GPA	.173	.039	4.439	<.001
	WK < > AGE	.349	.041	8.508	<.001
	PC < > ATT	.040	.039	1.027	.305
	PC < > GPA	.117	.039	3.037	.002
	PC < > AGE	.168	.039	4.280	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	ATT < > GPA	.068	.039	1.729	.084
	ATT < > AGE	-.094	.039	-2.402	.016
	GPA < > AGE	-.039	.039	-.990	.322
14P	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.180	<.001
	GPA	1.002	.055	18.332	<.001
	EDUC	1.006	.055	18.188	<.001
	PT1 < > PT4	.125	.038	3.286	.001**
	PT1 < > WK	.187	.038	4.873	<.001
	PT1 < > PC	.127	.038	3.348	<.001
	PT1 < > ATT	.046	.039	1.182	.237
	PT1 < > GPA	.234	.039	5.930	<.001
	PT1 < > EDUC	.442	.042	10.471	<.001
	PT4 < > WK	.290	.039	7.379	<.001
	PT4 < > PC	.266	.039	6.803	<.001
	PT4 < > ATT	.096	.039	2.473	.013**
	PT4 < > GPA	.120	.039	3.100	.002**
	PT4 < > EDUC	.172	.039	4.387	<.001
	WK < > PC	.399	.041	9.810	<.001
	WK < > ATT	-.026	.039	-.677	.498
	WK < > GPA	.174	.039	4.477	<.001
	WK < > EDUC	.300	.040	7.436	<.001
	PC < > ATT	.040	.039	1.027	.304
	PC < > GPA	.117	.039	3.025	.002**
	PC < > EDUC	.159	.039	4.063	<.001
	ATT < > GPA	.068	.039	1.722	.085
	ATT < > EDUC	-.099	.039	-2.523	.012**
	GPA < > EDUC	.055	.039	1.398	.162
14Q	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.180	<.001
	GPA	1.002	.055	18.332	<.001
	TRN_HRS	.999	.069	14.458	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT1 < > PT4	.125	.038	3.286	.001**
	PT1 < > WK	.187	.038	4.873	< .001
	PT1 < > PC	.127	.038	3.348	< .001
	PT1 < > ATT	.046	.039	1.179	.239
	PT1 < > GPA	.234	.039	5.930	< .001
	PT1 < > TRN_HRS	-.009	.049	-.181	.857
	PT4 < > WK	.290	.039	7.379	< .001
	PT4 < > PC	.266	.039	6.803	< .001
	PT4 < > ATT	.096	.039	2.466	.014**
	PT4 < > GPA	.120	.039	3.092	.002**
	PT4 < > TRN_HRS	-.083	.049	-1.702	.089**
	WK < > PC	.399	.041	9.810	< .001
	WK < > ATT	-.026	.039	-.675	.500
	WK < > GPA	.174	.039	4.475	< .001
	WK < > TRN_HRS	.010	.049	.211	.833
	PC < > ATT	.040	.039	1.019	.308
	PC < > GPA	.116	.039	3.014	.003**
	PC < > TRN_HRS	.005	.049	.100	.921
	ATT < > GPA	.068	.039	1.711	.087
	ATT < > TRN_HRS	.044	.050	.881	.378
	GPA < > TRN_HRS	-.019	.049	-.391	.696
14R	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.180	<.001
	GPA	1.002	.055	18.333	<.001
	BILLET	.242	.015	16.493	<.001
	PT1 < > PT4	.125	.038	3.286	.001
	PT1 < > WK	.187	.038	4.873	<.001
	PT1 < > PC	.127	.038	3.348	<.001
	PT1 < > ATT	.046	.039	1.180	.238
	PT1 < > GPA	.234	.039	5.933	<.001
	PT1 < > BILLET	.001	.021	.035	.972
	PT4 < > WK	.290	.039	7.379	<.001
	PT4 < > PC	.266	.039	6.803	<.001
	PT4 < > ATT	.096	.039	2.467	.014
	PT4 < > GPA	.119	.039	3.073	.002

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT4 < > BILLET	-.031	.021	-1.471	.141
	WK < > PC	.399	.041	9.810	<.001
	WK < > ATT	-.026	.039	-.679	.497
	WK < > GPA	.174	.039	4.454	<.001
	WK < > BILLET	.002	.021	.074	.941
	PC < > ATT	.040	.039	1.025	.305
	PC < > GPA	.116	.039	2.998	.003
	PC < > BILLET	-.007	.021	-.341	.733
	ATT < > GPA	.069	.039	1.747	.081
	ATT < > BILLET	.017	.022	.804	.422
	GPA < > BILLET	-.021	.021	-.988	.323
14S	PT1	.999	.053	18.708	<.001
	PT4	.999	.053	18.708	<.001
	WK	.999	.053	18.708	<.001
	PC	.999	.053	18.708	<.001
	ATT	.999	.055	18.180	<.001
	GPA	1.003	.055	18.331	<.001
	SEX	.201	.011	18.708	<.001
	PT1 < > PT4	.125	.038	3.286	.001
	PT1 < > WK	.187	.038	4.873	<.001
	PT1 < > PC	.127	.038	3.348	<.001
	PT1 < > ATT	.046	.039	1.191	.234
	PT1 < > GPA	.234	.039	5.933	<.001
	PT1 < > SEX	-.045	.017	-2.637	.008
	PT4 < > WK	.290	.039	7.379	<.001
	PT4 < > PC	.266	.039	6.803	<.001
	PT4 < > ATT	.097	.039	2.476	.013
	PT4 < > GPA	.120	.039	3.092	.002
	PT4 < > SEX	.029	.017	1.713	.087
	WK < > PC	.399	.041	9.810	<.001
	WK < > ATT	-.026	.039	-.675	.499
	WK < > GPA	.175	.039	4.479	<.001
	WK < > SEX	.033	.017	1.969	.033
	PC < > ATT	.040	.039	1.024	.306
	PC < > GPA	.117	.039	3.017	.003
	PC < > SEX	.047	.017	2.782	.005
	ATT < > GPA	.067	.039	1.711	.087
	ATT < > SEX	.011	.017	.656	.512

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	GPA < > SEX	-.016	.017	-.948	.343

**p < .05

Chinese Listening Variances and Covariances

Phase II

Table 194. Chinese Listening Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
15B	APT	.999	.046	21.772	< .001
15C	APT	.999	.046	21.772	< .001
	COG	.999	.046	21.772	< .001
	APT < > COG	.384	.035	11.059	< .001
15D	APT	.999	.046	21.772	< .001
	COG	.999	.046	21.772	< .001
	ATT	.999	.047	21.424	< .001
	APT < > COG	.384	.035	11.059	< .001
	APT < > ATT	.132	.033	3.957	< .001
	COG < > ATT	.101	.033	3.039	.002**

**p < .05

Phase III

Table 195. Chinese Listening Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
15E	PT3	.999	.046	21.772	< .001
15F	PT3	.999	.046	21.772	< .001
	PT2	.999	.046	21.772	< .001
	PT3 < > PT2	.277	.034	8.225	< .001
15G	PT3	.999	.046	21.772	< .001
	PT2	.999	.046	21.772	< .001
	PT1	.999	.046	21.772	< .001
	PT3 < > PT2	.277	.034	8.225	< .001
	PT3 < > PT1	.073	.033	2.249	.025*
	PT2 < > PT1	.026	.032	.796	.426
15H	PT3	.999	.046	21.772	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT2	.999	.046	21.772	< .001
	PT1	.999	.046	21.772	< .001
	PT4	.999	.046	21.772	< .001
	PT3 < > PT2	.277	.034	8.225	< .001
	PT3 < > PT1	.073	.033	2.249	.025*
	PT3 < > PT4	.233	.033	7.007	< .001
	PT2 < > PT1	.026	.032	.796	.426
	PT2 < > PT4	.039	.032	1.212	.226
	PT1 < > PT4	.027	.032	.832	.405
15I	PT3	.999	.046	21.772	< .001
	PT2	.999	.046	21.772	< .001
	PT1	.999	.046	21.772	< .001
	PT4	.999	.046	21.772	< .001
	WK	.999	.046	21.772	< .001
	PT3 < > PT2	.277	.034	8.225	< .001
	PT3 < > PT1	.073	.033	2.249	.025**
	PT3 < > PT4	.233	.033	7.007	< .001
	PT3 < > WK	.221	.033	6.641	< .001
	PT2 < > PT1	.026	.032	.796	.426
	PT2 < > PT4	.039	.032	1.212	.226
	PT2 < > WK	.106	.033	3.260	.001**
	PT1 < > PT4	.027	.032	.832	.405
	PT1 < > WK	.172	.033	5.238	< .001
	PT4 < > WK	.237	.033	7.096	< .001
15J	PT3	.999	.046	21.772	< .001
	PT2	.999	.046	21.772	< .001
	PT1	.999	.046	21.772	< .001
	PT4	.999	.046	21.772	< .001
	PC	.999	.046	21.772	< .001
	PT3 < > PT2	.277	.034	8.225	< .001
	PT3 < > PT1	.073	.033	2.249	.025**
	PT3 < > PT4	.233	.033	7.007	< .001
	PT3 < > PC	.192	.033	5.799	< .001
	PT2 < > PT1	.026	.032	.796	.426
	PT2 < > PT4	.039	.032	1.212	.226
	PT2 < > PC	.084	.033	2.572	.010**
	PT1 < > PT4	.027	.032	.832	.405
	PT1 < > PC	.133	.033	4.075	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	P4 < > PC	.199	.033	6.012	< .001
15K	PT3	.999	.046	21.772	< .001
	PT2	.999	.046	21.772	< .001
	PT1	.999	.046	21.772	< .001
	PT4	.999	.046	21.772	< .001
	PC	.999	.046	21.772	< .001
	AR	.999	.046	21.772	< .001
	PT3 < > PT2	.277	.034	8.225	< .001
	PT3 < > PT1	.073	.033	2.249	.025**
	PT3 < > PT4	.233	.033	7.007	< .001
	PT3 < > PC	.192	.033	5.799	< .001
	PT3 < > AR	.247	.033	7.403	< .001
	PT2 < > PT1	.026	.032	.796	.426
	PT2 < > PT4	.039	.032	1.212	.226
	PT2 < > PC	.084	.033	2.572	.010**
	PT4 < > PC	.199	.033	6.012	< .001
	PT4 < > AR	.345	.034	10.038	< .001
	PC < > AR	.331	.034	9.683	< .001
15L	PT3	.999	.046	21.772	< .001
	PT2	.999	.046	21.772	< .001
	PT1	.999	.046	21.772	< .001
	PT4	.999	.046	21.772	< .001
	PC	.999	.046	21.772	< .001
	MK	.999	.046	21.772	< .001
	PT3 < > PT2	.277	.034	8.225	< .001
	PT3 < > PT1	.073	.033	2.249	.025**
	PT3 < > PT4	.233	.033	7.007	< .001
	PT3 < > PC	.192	.033	5.799	< .001
	PT3 < > MK	.213	.033	6.425	< .001
	PT2 < > PT1	.026	.032	.796	.426
	PT2 < > PT4	.039	.032	1.212	.226
	PT2 < > PC	.084	.033	2.572	.010**
	PT2 < > MK	.024	.032	.729	.466
	PT1 < > PC	.133	.033	4.075	< .001
	PT1 < > MK	.112	.033	3.435	< .001
	PT1 < > PT4	.027	.032	.832	.405
	PT4 < > PC	.199	.033	6.012	< .001
	PT4 < > MK	.299	.034	8.833	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PC < > MK	.192	.033	5.804	< .001

**p < .05

Phase IV

Table 196. Chinese Listening Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
15M	PT3	.999	.046	21.772	<.001
	PT2	.999	.046	21.772	<.001
	PT1	.999	.046	21.772	<.001
	PT4	.999	.046	21.772	<.001
	PC	.999	.046	21.772	<.001
	MK	.999	.046	21.772	<.001
	GPA	1.000	.047	21.426	<.001
	PT3 < > PT2	.277	.034	8.225	<.001
	PT3 < > PT1	.073	.033	2.249	.025**
	PT3 < > PT4	.233	.033	7.007	<.001
	PT3 < > PC	.192	.033	5.799	<.001
	PT3 < > MK	.213	.033	6.425	<.001
	PT3 < > GPA	.227	.034	6.740	<.001
	PT2 < > PT1	.026	.032	.796	.426
	PT2 < > PT4	.039	.032	1.212	.226
	PT2 < > PC	.084	.033	2.572	.010**
	PT2 < > MK	.024	.032	.729	.466
	PT2 < > GPA	.160	.033	4.811	<.001
	PT1 < > PT4	.027	.032	.832	.405
	PT1 < > PC	.133	.033	4.075	<.001
	PT1 < > MK	.112	.033	3.435	<.001
	PT1 < > GPA	.174	.033	5.224	< .001
	PT4 < > PC	.199	.033	6.012	<.001
	PT4 < > MK	.299	.034	8.833	<.001
	PT4 < > GPA	.119	.033	3.595	<.001
	PC < > MK	.192	.033	5.804	<.001
	PC < > GPA	.099	.033	3.003	.003**
	MK < > GPA	.126	.033	3.808	<.001
15N	PT1	.999	.046	21.772	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT4	.999	.046	21.772	<.001
	PC	.999	.046	21.772	<.001
	GPA	.998	.047	21.421	<.001
	AGE	.999	.047	21.399	<.001
	PT1 < > PT4	.027	.032	.832	.405
	PT1 < > PC	.133	.033	4.075	<.001
	PT1 < > GPA	.173	.033	5.203	<.001
	PT1 < > AGE	.251	.034	7.405	.666
	PT4 < > PC	.199	.033	6.012	.157
	PT4 < > GPA	.118	.033	3.570	<.001
	PT4 < > AGE	.116	.033	3.489	<.001
	PC < > GPA	.099	.033	2.995	.003**
	PC < > AGE	.278	.034	8.149	<.001
	GPA < > AGE	-.052	.033	-1.565	.118
15O	PT1	.999	.046	21.772	<.001
	PT4	.999	.046	21.772	<.001
	PC	.999	.046	21.772	<.001
	GPA	.998	.047	21.422	<.001
	AGE	.999	.047	21.406	<.001
	EDUC	.998	.047	21.396	<.001
	PT1 < > PT4	.027	.032	.832	.405
	PT1 < > PC	.133	.033	4.075	<.001
	PT1 < > GPA	.173	.033	5.211	<.001
	PT1 < > AGE	.251	.034	7.404	<.001
	PT1 < > EDUC	.402	.035	11.367	<.001
	PT4 < > PC	.199	.033	6.012	<.001
	PT4 < > GPA	.118	.033	3.573	<.001
	PT4 < > AGE	.117	.033	3.528	<.001
	PT4 < > EDUC	.151	.033	4.532	<.001
	PC < > GPA	.099	.033	3.004	.003**
	PC < > AGE	.279	.034	8.179	<.001
	PC < > EDUC	.230	.034	6.828	<.001
	GPA < > AGE	-.052	.033	-1.571	.116
	GPA < > EDUC	.076	.033	2.280	.023**
	AGE < > EDUC	.647	.039	16.461	<.001
15P	PT1	.999	.046	21.772	<.001
	PT4	.999	.046	21.772	<.001
	PC	.999	.046	21.772	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	GPA	.998	.047	21.421	<.001
	AGE	.999	.047	21.399	<.001
	TRN_HRS	.999	.057	17.622	<.001
	PT1 < > PT4	.027	.032	.832	.405
	PT1 < > PC	.133	.033	4.075	<.001
	PT1 < > GPA	.173	.033	5.201	<.001
	PT1 < > AGE	.251	.034	7.409	<.001
	PT1 < > TRN_HRS	-.088	.040	-2.201	.028**
	PT4 < > PC	.199	.033	6.012	<.001
	PT4 < > GPA	.118	.033	3.566	<.001
	PT4 < > AGE	.116	.033	3.490	<.001
	PT4 < > TRN_HRS	-.029	.040	-.723	.470
	PC < > GPA	.099	.033	2.994	.003**
	PC < > AGE	.278	.034	8.145	<.001
	PC < > TRN_HRS	-.019	.040	-.474	.636
	GPA < > AGE	-.052	.033	-1.559	.119
	GPA< > TRN_HRS	-.039	.040	-.975	.330
	AGE < > TRN_HRS	.020	.041	.490	.624
15Q	PT1	.999	.046	21.772	<.001
	PT4	.999	.046	21.772	<.001
	PC	.999	.046	21.772	<.001
	GPA	.998	.047	21.421	<.001
	AGE	.999	.047	21.399	<.001
	BILLET	.249	.013	19.300	<.001
	PT1 < > PT4	.027	.032	.832	.405
	PT1 < > PC	.133	.033	4.075	<.001
	PT1 < > GPA	.173	.033	5.202	<.001
	PT1 < > AGE	.252	.034	7.414	<.001
	PT1 < > BILLET	-.011	.018	-.611	.541
	PT4 < > PC	.199	.033	6.012	<.001
	PT4 < > GPA	.118	.033	3.567	<.001
	PT4 < > AGE	.116	.033	3.490	<.001
	PT4 < > BILLET	.001	.018	.067	.947
	PC < > GPA	.099	.033	2.993	.003**
	PC < > AGE	.279	.034	8.161	<.001
	PC < > BILLET	.013	.018	.686	.492
	GPA < > AGE	-.052	.033	-1.554	.120
	GPA< > BILLET	.003	.018	.138	.891

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	AGE < > BILLET	.008	.019	.430	.667
15R	PT1	.999	.046	21.772	<.001
	PT4	.999	.046	21.772	<.001
	PC	.999	.046	21.772	<.001
	GPA	.997	.047	21.422	<.001
	AGE	.998	.047	21.400	<.001
	SEX	.197	.009	21.772	<.001
	PT1 < > PT4	.027	.032	.832	.405
	PT1 < > PC	.133	.033	4.075	<.001
	PT1 < > GPA	.173	.033	5.193	<.001
	PT1 < > AGE	.251	.034	7.411	<.001
	PT1 < > SEX	-.039	.014	-2.709	.007**
	PT4 < > PC	.199	.033	6.012	<.001
	PT4 < > GPA	.118	.033	3.577	<.001
	PT4 < > AGE	.115	.033	3.468	<.001
	PT4 < > SEX	.054	.015	3.705	<.001
	PC < > GPA	.098	.033	2.976	.003**
	PC < > AGE	.278	.034	8.134	<.001
	PC < > SEX	.081	.015	5.510	<.001
	GPA < > AGE	-.052	.033	-1.551	.121
	GPA < > SEX	-.026	.015	-1.782	.075
	AGE < > SEX	.057	.015	3.875	<.001

**p < .05

Chinese Reading Variances and Covariances

Phase II

Table 197. Chinese Reading Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
16B	APT	.999	.046	21.783	<.001
16C	APT	.999	.046	21.783	<.001
	COG	.999	.046	21.783	<.001
	APT < > COG	.386	.035	11.111	<.001
16D	APT	.999	.046	21.783	<.001
	COG	.999	.046	21.783	<.001
	ATT	.999	.047	21.424	<.001
	APT < > COG	.386	.035	11.111	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	APT < > ATT	.133	.033	4.014	<.001
	COG < > ATT	.104	.033	3.147	.002**

**p < .05

Phase III

Table 198. Chinese Reading Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
16E	PT3	.999	.046	21.783	<.001
16F	PT3	.999	.046	21.783	<.001
	PT2	.999	.046	21.783	<.001
	PT3 < > PT2	.274	.034	8.155	<.001
16G	PT3	.999	.046	21.783	<.001
	PT1	.999	.046	21.783	<.001
	PT3 < > PT1	.072	.033	2.225	.026**
16H	PT3	.999	.046	21.783	<.001
	PT1	.999	.046	21.783	<.001
	PT4	.999	.046	21.783	<.001
	PT3 < > PT1	.072	.033	2.225	.026**
	PT3 < > PT4	.230	.033	6.901	<.001
	PT1 < > PT4	.032	.032	.975	.330
16I	PT3	.999	.046	21.783	<.001
	PT1	.999	.046	21.783	<.001
	PT4	.999	.046	21.783	<.001
	WK	.999	.046	21.783	<.001
	PT3 < > PT1	.072	.033	2.225	.026**
	PT3 < > PT4	.230	.033	6.901	<.001
	PT3 < > WK	.219	.033	6.585	<.001
	PT1 < > PT4	.032	.032	.975	.330
	PT1 < > WK	.173	.033	5.242	<.001
	PT4 < > WK	.237	.033	7.118	<.001
16J	PT3	.999	.046	21.783	<.001
	PT1	.999	.046	21.783	<.001
	PT4	.999	.046	21.783	<.001
	WK	.999	.046	21.783	<.001
	PC	.999	.046	21.783	<.001
	PT3 < > PT1	.072	.033	2.225	.026**

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT3 < > PT4	.230	.033	6.901	<.001
	PT3 < > WK	.219	.033	6.585	<.001
	PT3 < > PC	.190	.033	5.766	<.001
	PT1 < > PT4	.032	.032	.975	.330
	PT1 < > WK	.173	.033	5.242	<.001
	PT1 < > PC	.134	.033	4.096	<.001
	P4 < > WK	.237	.033	7.118	<.001
	P4 < > PC	.202	.033	6.109	< .001
	WK < > PC	.496	.036	13.690	<.001
16K	PT3	.999	.046	21.783	<.001
	PT1	.999	.046	21.783	<.001
	PT4	.999	.046	21.783	<.001
	PC	.999	.046	21.783	<.001
	AR	.999	.046	21.783	<.001
	PT3 < > PT1	.072	.033	2.225	.026**
	PT3 < > PT4	.230	.033	6.901	<.001
	PT3 < > PC	.190	.033	5.766	<.001
	PT3 < > AR	.247	.033	7.392	<.001
	PT1 < > PT4	.032	.032	.975	.330
	PT1 < > PC	.134	.033	4.096	<.001
	PT1 < > AR	.099	.033	3.028	.002**
	PT4 < > PC	.202	.033	6.109	<.001
	PT4 < > AR	.347	.034	10.106	<.001
	PC < > AR	.331	.034	9.696	<.001
16L	PT3	.999	.046	21.783	<.001
	PT1	.999	.046	21.783	<.001
	PT4	.999	.046	21.783	<.001
	PC	.999	.046	21.783	<.001
	MK	.999	.046	21.783	<.001
	PT3 < > PT1	.072	.033	2.225	.026
	PT3 < > PT4	.230	.033	6.901	<.001
	PT3 < > PC	.190	.033	5.766	<.001
	PT3 < > MK	.210	.033	6.325	<.001
	PT1 < > PT4	.032	.032	.975	.330
	PT1 < > PC	.134	.033	4.096	.057
	PT1 < > MK	.210	.033	6.325	.028
	PT4 < > PC	.202	.033	6.109	<.001
	PT4 < > MK	.306	.034	9.031	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PC < > MK	.192	.033	5.807	<.001
16M	PT3	.999	.046	21.783	<.001
	PT1	.999	.046	21.783	<.001
	PT4	.999	.046	21.783	<.001
	PC	.999	.046	21.783	<.001
	PT3 < > PT1	.072	.033	2.225	.026
	PT3 < > PT4	.230	.033	6.901	<.001
	PT3 < > PC	.190	.033	5.766	<.001
	PT1 < > PT4	.032	.032	.975	.330
	PT1 < > PC	.134	.033	4.096	<.001
	PT4 < > PC	.202	.033	6.109	<.001

**p < .05

Phase IV

Table 199. Chinese Reading Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
16N	PT3	.999	.046	21.783	<.001
	PT1	.999	.046	21.783	<.001
	PT4	.999	.046	21.783	<.001
	PC	.999	.046	21.783	<.001
	GPA	.999	.046	21.783	<.001
	PT3 < > PT1	.072	.033	2.225	.026**
	PT3 < > PT4	.230	.033	6.901	<.001
	PT3 < > PC	.190	.033	5.766	<.001
	PT3 < > GPA	.233	.034	6.912	<.001
	PT1 < > PT4	.032	.032	.975	.330
	PT1 < > PC	.134	.033	4.096	<.001
	PT1 < > GPA	.177	.033	5.305	<.001
	PT4 < > PC	.202	.033	6.109	<.001
	PT4 < > GPA	.116	.033	3.493	<.001
	PC < > GPA	.100	.033	3.036	.002**
16O	PT4	.999	.046	21.783	<.001
	PC	.999	.046	21.783	<.001
	GPA	1.000	.047	21.404	<.001
	AGE	.999	.046	21.783	<.001
	PT4 < > PC	.202	.033	6.109	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PT4 < > GPA	.115	.033	3.466	<.001
	PT4 < > AGE	.112	.033	3.378	<.001
	PC < > GPA	.100	.033	3.016	.003
	PC < > AGE	.280	.034	8.196	<.001
	GPA < > AGE	-.052	.033	-1.541	.123
16P	PT4	.999	.046	21.783	<.001
	PC	.999	.046	21.783	<.001
	GPA	.999	.047	21.403	<.001
	EDUC	.998	.047	21.368	<.001
	PT4 < > PC	.202	.033	6.109	<.001
	PT4 < > GPA	.114	.033	3.448	<.001
	PT4 < > EDUC	.146	.033	4.384	<.001
	PC < > GPA	.100	.033	3.016	.003**
	PC < > EDUC	.234	.034	6.922	<.001
	GPA < > EDUC	.079	.034	2.353	.019**
16Q	PT4	.999	.046	21.783	<.001
	PC	.999	.046	21.783	<.001
	GPA	.999	.047	21.404	<.001
	TRN_HRS	1.001	.057	17.622	<.001
	PT4 < > PC	.202	.033	6.109	<.001
	PT4 < > GPA	.114	.033	3.444	<.001
	PT4 < > TRN_HRS	-.030	.040	-.749	.454
	PC < > GPA	.100	.033	3.015	.003**
	PC < > TRN_HRS	-.018	.040	-.441	.660
	GPA < > TRN_HRS	-.031	.040	-.768	.443
16R	PT4	.999	.046	21.783	< .001
	PC	.999	.046	21.783	< .001
	GPA	.999	.047	21.404	< .001
	TRN_HRS	1.000	.057	17.624	< .001
	BILLET	.249	.013	19.314	< .001
	PT4 < > PC	.202	.033	6.109	< .001
	PT4 < > GPA	.114	.033	3.445	< .001
	PT4 < > TRN_HRS	-.032	.040	-.806	.420
	PT4 < > BILLET	.001	.018	.077	.938
	PC < > GPA	.100	.033	3.017	.003**
	PC < > TRN_HRS	-.021	.040	-.525	.600
	PC < > BILLET	.012	.018	.684	.494
	GPA < >TRN_HRS	-.029	.040	-.726	.468

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	GPA< > BILLET	.004	.018	.210	.834
	TRN_HRS < > BILLET	.071	.021	3.377	< .001
16S	PT4	.999	.046	21.783	< .001
	PC	.999	.046	21.783	< .001
	GPA	.998	.047	21.404	< .001
	TRN_HRS	1.001	.057	17.622	< .001
	SEX	.197	.009	21.783	< .001
	PT4 < > PC	.202	.033	6.109	< .001
	PT4 < > GPA	.114	.033	3.447	< .001
	PT4 < > TRN_HRS	-.029	.040	-.737	.461
	PT4 < > SEX	.052	.014	3.596	< .001
	PC < > GPA	.099	.033	3.004	.003**
	PC < > TRN_HRS	-.018	.040	-.442	.659
	PC < > SEX	.080	.015	5.466	< .001
	GPA < > TRN_HRS	-.032	.040	-.782	.434
	GPA < > SEX	-.026	.015	-1.813	.070
	TRN_HRS < > SEX	-.023	.018	-1.309	.190

**p < .05

Korean Listening Variances and Covariances

Phase II

Table 200. Korean Listening Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
17B	APT	.999	.053	18.881	< .001
17C	APT	.999	.053	18.881	< .001
	COG	.999	.053	18.881	< .001
	APT < > COG	.349	.040	8.818	< .001
17D	APT	.999	.053	18.881	< .001
	COG	.999	.053	18.881	< .001
	ATT	.999	.059	16.942	< .001
	APT < > COG	.349	.040	8.818	< .001
	APT < > ATT	.101	.042	2.407	.016**
	COG < > ATT	-.026	.042	-.615	.539

**p < .05

Table 201. Korean Listening Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
17E	PT3	.999	.053	18.881	< .001
17F	PT2	.999	.053	18.881	< .001
17G	PT1	.999	.053	18.881	< .001
17H	PT1	.999	.053	18.881	< .001
	PT4	.999	.053	18.881	< .001
	PT1 < > PT4	.063	.037	1.687	.092
17I	PT4	.999	.053	18.881	< .001
	WK	.999	.053	18.881	< .001
	PT4 < > WK	.170	.038	4.484	< .001
17J	PT4	.999	.053	18.881	< .001
	PC	.999	.053	18.881	< .001
	PT4 < > PC	.185	.038	4.852	< .001
17K	PT4	.999	.053	18.881	< .001
	PC	.999	.053	18.881	< .001
	AR	.999	.053	18.881	< .001
	PT4 < > PC	.185	.038	4.852	< .001
	PT4 < > AR	.274	.039	7.066	< .001
	PC < > AR	.262	.039	6.788	< .001
17L	PT4	.999	.053	18.881	< .001
	PC	.999	.053	18.881	< .001
	AR	.999	.053	18.881	< .001
	MK	.999	.053	18.881	< .001
	PT4 < > PC	.185	.038	4.852	< .001
	PT4 < > AR	.274	.039	7.066	< .001
	PT4 < > MK	.162	.038	4.284	< .001
	PC < > AR	.262	.039	6.788	< .001
	PC < > MK	.112	.038	2.980	.003**
	AR < > MK	.550	.043	12.877	< .001
17M	PT4	.999	.053	18.881	< .001
	PC	.999	.053	18.881	< .001
	MK	.999	.053	18.881	< .001
	PT4 < > PC	.185	.038	4.852	< .001
	PT4 < > MK	.162	.038	4.284	< .001
	PC < > MK	.112	.038	2.980	.003**

**p < .05

Phase IV

Table 202. Korean Listening Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
17N	PT4	.999	.053	18.881	<.001
	PC	.999	.053	18.881	<.001
	MK	.999	.053	18.881	<.001
	GPA	1.012	.056	18.086	<.001
	PT4 < > PC	.185	.038	4.852	<.001
	PT4 < > MK	.162	.038	4.284	<.001
	PT4 < > GPA	.110	.039	2.810	.005**
	PC < > MK	.112	.038	2.980	.003**
	PC < > GPA	.154	.039	3.925	<.001
	MK < > GPA	.189	.040	4.769	<.001
17O	PC	.999	.053	18.881	<.001
	GPA	1.009	.056	18.080	<.001
	AGE	.999	.059	16.898	<.001
	PC < > GPA	.155	.039	3.931	<.001
	PC < > AGE	.123	.042	2.944	.003
	GPA < > AGE	.013	.043	.307	.759
17P	PC	.999	.053	18.881	<.001
	GPA	1.009	.056	18.080	<.001
	AGE	.999	.059	16.907	<.001
	EDUC	.997	.059	16.896	<.001
	PC < > GPA	.155	.039	3.940	<.001
	PC < > AGE	.123	.042	2.936	.003**
	PC < > EDUC	.177	.042	4.209	< .001
	GPA < > AGE	.010	.043	.234	.815
	GPA< > EDUC	.058	.043	1.362	.173
	AGE < > EDUC	.614	.049	12.516	<.001
17Q	PC	.999	.053	18.881	<.001
	GPA	1.009	.056	18.080	<.001
	AGE	.999	.059	16.898	<.001
	TRN_HRS	.998	.075	13.287	<.001
	PC < > GPA	.155	.039	3.930	<.001
	PC < > AGE	.123	.042	2.934	.003
	PC < > TRN_HRS	.028	.053	.539	.590
	GPA < > AGE	.014	.043	.315	.753

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	GPA< > TRN_HRS	-.028	.054	-.515	.607
	AGE < > TRN_HRS	.101	.056	1.814	.070
17R	PC	.999	.053	18.881	<.001
	GPA	1.009	.056	18.080	<.001
	AGE	.999	.059	16.898	<.001
	BILLET	.248	.016	15.780	<.001
	PC < > GPA	.154	.039	3.929	<.001
	PC < > AGE	.123	.042	2.943	.003**
	PC < > BILLET	-.008	.022	-.351	.725
	GPA < > AGE	.013	.043	.308	.758
	GPA < > BILLET	.039	.023	1.692	.091
	AGE < > BILLET	.013	.024	.532	.595
17S	PC	.999	.053	18.881	<.001
	GPA	1.008	.056	18.080	<.001
	AGE	.998	.059	16.899	<.001
	SEX	.192	.010	18.881	<.001
	PC < > GPA	.154	.039	3.925	<.001
	PC < > AGE	.123	.042	2.940	.003**
	PC < > SEX	.035	.016	2.120	.034**
	GPA < > AGE	.012	.043	.272	.785
	GPA < > SEX	-.023	.017	-1.340	.180
	AGE < > SEX	.041	.018	2.215	.027**

**p < .05

Korean Reading Variances and Covariances

Phase II

Table 203. Korean Reading Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
18B	APT	.999	.053	18.855	<.001
18C	APT	.999	.053	18.855	<.001
	COG	.999	.053	18.855	<.001
	APT < > COG	.348	.040	8.778	<.001
18D	APT	.999	.053	18.855	<.001
	COG	.999	.053	18.855	<.001
	ATT	.998	.059	16.912	<.001

APT < > COG	.348	.040	8.778	<.001
APT < > ATT	.100	.042	2.394	.017**
COG < > ATT	-.028	.042	-.662	.508

**p < .05

Phase III

Table 204. Korean Reading Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
18E	PT3	.999	.053	18.855	<.001
18F	PT3	.999	.053	18.855	<.001
	PT2	.999	.053	18.855	<.001
	PT3 < > PT2	.250	.039	6.475	<.001
18G	PT3	.999	.053	18.855	<.001
	PT1	.999	.053	18.855	<.001
	PT3 < > PT1	.110	.038	2.917	.004**
18H	PT3	.999	.053	18.855	<.001
	PT1	.999	.053	18.855	<.001
	PT4	.999	.053	18.855	<.001
	PT3 < > PT1	.110	.038	2.917	.004
	PT3 < > PT4	.203	.038	5.317	<.001
	PT1 < > PT4	.062	.038	1.654	.098
18I	PT3	.999	.053	18.855	<.001
	PT1	.999	.053	18.855	<.001
	PT4	.999	.053	18.855	<.001
	WK	.999	.053	18.855	<.001
	PT3 < > PT1	.110	.038	2.917	.004**
	PT3 < > PT4	.203	.038	5.317	<.001
	PT3 < > WK	.291	.039	7.463	<.001
	PT1 < > PT4	.062	.038	1.654	.098
	PT1 < > WK	.172	.038	4.522	<.001
	PT4 < > WK	.174	.038	4.582	<.001
18J	PT3	.999	.053	18.855	<.001
	PT1	.999	.053	18.855	<.001
	PT4	.999	.053	18.855	<.001
	PC	.999	.053	18.855	<.001
	PT3 < > PT1	.110	.038	2.917	.004
	PT3 < > PT4	.203	.038	5.317	<.001
	PT3 < > PC	.195	.038	5.101	<.001
	PT1 < > PT4	.062	.038	1.654	.098

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT1 < > PC	.090	.038	2.400	.016
	P4 < > PC	.185	.038	4.865	<.001
18K	PT3	.999	.053	18.855	<.001
	PT1	.999	.053	18.855	<.001
	PT4	.999	.053	18.855	<.001
	PC	.999	.053	18.855	<.001
	AR	.999	.053	18.855	<.001
	PT3 < > PT1	.110	.038	2.917	.004
	PT3 < > PT4	.203	.038	5.317	<.001
	PT3 < > PC	.195	.038	5.101	<.001
	PT3 < > AR	.213	.038	5.572	<.001
	PT1 < > PT4	.062	.038	1.654	.098
	PT1 < > PC	.090	.038	2.400	.016**
	PT1 < > AR	.055	.038	1.454	.146
	PT4 < > PC	.185	.038	4.865	<.001
	PT4 < > AR	.273	.039	7.038	<.001
	PC < > AR	.264	.039	6.808	<.001
18L	PT1	.999	.053	18.855	<.001
	PT4	.999	.053	18.855	<.001
	PC	.999	.053	18.855	<.001
	MK	.999	.053	18.855	<.001
	PT1 < > PT4	.062	.038	1.654	.098
	PT1 < > PC	.090	.038	2.400	.016**
	PT1 < > MK	.027	.037	.709	.478
	PT4 < > PC	.185	.038	4.865	<.001
	PT4 < > MK	.160	.038	4.225	<.001
	PC < > MK	.111	.038	2.933	.003**

**p < .05

Phase IV

Table 205. Korean Reading Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
18M	PT1	.999	.053	18.855	< .001
	PT4	.999	.053	18.855	< .001
	PC	.999	.053	18.855	< .001
	AR	.999	.053	18.855	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	MK	.999	.053	18.855	< .001
	GPA	.999	.053	18.855	< .001
	PT1 < > PT4	.062	.038	1.654	.098
	PT1 < > PC	.090	.038	2.400	< .001
	PT1 < > AR	.055	.038	1.454	.146
	PT1 < > MK	.027	.037	.709	.478
	PT1 < > GPA	.214	.040	5.405	< .001
	PT4 < > PC	.185	.038	4.865	< .001
	PT4 < > AR	.273	.039	7.038	< .001
	PT4 < > MK	.160	.038	4.225	< .001
	PT4 < > GPA	.111	.039	2.843	.004**
	PC < > AR	.264	.039	6.808	< .001
	PC < > MK	.111	.038	2.933	.003**
	PC < > GPA	.156	.039	3.989	< .001
	AR < > MK	.551	.043	12.878	< .001
	AR < > GPA	.172	.039	4.385	< .001
	MK < > GPA	.187	.039	4.738	< .001
18N	PT4	.999	.053	18.855	< .001
	PC	.999	.053	18.855	< .001
	AR	.999	.053	18.855	< .001
	GPA	1.003	.056	18.059	< .001
	AGE	1.000	.059	16.869	< .001
	PT4 < > PC	.185	.038	4.865	< .001
	PT4 < > AR	.273	.039	7.038	< .001
	PT4 < > GPA	.111	.039	2.843	.004
	PT4 < > AGE	.086	.042	2.058	.040
	PC < > AR	.264	.039	6.808	< .001
	PC < > GPA	.158	.039	4.014	< .001
	PC < > AGE	.133	.042	3.170	.002
	AR < > GPA	.175	.039	4.440	< .001
	AR < > AGE	.098	.042	2.328	.020
	GPA < > AGE	-.007	.043	-.170	.865
18O	PT4	.999	.053	18.855	< .001
	PC	.999	.053	18.855	< .001
	AR	.999	.053	18.855	< .001
	GPA	1.003	.056	18.059	< .001
	AGE	1.000	.059	16.878	< .001
	EDUC	.999	.059	16.869	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT4 < > PC	.185	.038	4.865	< .001
	PT4 < > AR	.273	.039	7.038	< .001
	PT4 < > GPA	.111	.039	2.842	.004**
	PT4 < > AGE	.088	.042	2.095	.036**
	PT4 < > EDUC	.132	.042	3.152	.002**
	PC < > AR	.264	.039	6.808	< .001
	PC < > GPA	.158	.039	4.016	< .001
	PC < > AGE	.133	.042	3.175	.001**
	PC < > EDUC	.184	.042	4.361	< .001
	AR < > GPA	.175	.039	4.441	< .001
	AR < > AGE	.097	.042	2.330	.020**
	AR < > EDUC	.098	.042	2.341	.019**
	GPA < > AGE	-.007	.043	-.153	.878
	GPA < > EDUC	.050	.043	1.160	.246
	AGE < > EDUC	.616	.049	12.512	< .001
18P	PT4	.999	.053	18.855	< .001
	PC	.999	.053	18.855	< .001
	AR	.999	.053	18.855	< .001
	GPA	1.003	.056	18.059	< .001
	AGE	.999	.059	16.870	< .001
	TRN_HRS	.998	.075	13.286	< .001
	PT4 < > PC	.185	.038	4.865	< .001
	PT4 < > AR	.273	.039	7.038	< .001
	PT4 < > GPA	.111	.039	2.842	.004**
	PT4 < > AGE	.086	.042	2.050	.040**
	PT4 < > TRN_HRS	.028	.053	.534	.593
	PC < > AR	.264	.039	6.808	< .001
	PC < > GPA	.158	.039	4.014	< .001
	PC < > AGE	.133	.042	3.162	.002**
	PC < > TRN_HRS	.034	.053	.637	.524
	AR < > GPA	.175	.039	4.441	< .001
	AR < > AGE	.097	.042	2.309	.021**
	AR < > TRN_HRS	.079	.053	1.497	.134
	GPA < > AGE	-.006	.043	-.149	.881
	GPA < > TRN_HRS	-.018	.054	-.322	.747
	AGE < > TRN_HRS	.099	.056	1.778	.075
18Q	PT4	.999	.053	18.855	< .001
	PC	.999	.053	18.855	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	AR	.999	.053	18.855	< .001
	GPA	1.002	.056	18.059	< .001
	AGE	.999	.059	16.869	< .001
	BILLET	.248	.016	15.764	< .001
	PT4 < > PC	.185	.038	4.865	< .001
	PT4 < > AR	.273	.039	7.038	< .001
	PT4 < > GPA	.111	.039	2.842	.004**
	PT4 < > AGE	.085	.042	2.042	.041**
	PT4 < > BILLET	-.018	.022	-.804	.421
	PC < > AR	.264	.039	6.808	< .001
	PC < > GPA	.158	.039	4.010	< .001
	PC < > AGE	.133	.042	3.170	.002**
	PC < > BILLET	-.010	.022	-.445	.656
	AR < > GPA	.175	.039	4.441	< .001
	AR < > AGE	.097	.042	2.312	.021**
	AR < > BILLET	-.015	.022	-.672	.501
	GPA < >AGE	-.007	.043	-.170	.865
	GPA< > BILLET	.037	.023	1.620	.105
	AGE < > BILLET	.007	.024	.292	.770
18R	PT4	.999	.053	18.855	< .001
	PC	.999	.053	18.855	< .001
	AR	.999	.053	18.855	< .001
	GPA	1.002	.055	18.061	< .001
	AGE	.999	.059	16.870	< .001
	SEX	.192	.010	18.855	< .001
	PT4 < > PC	.185	.038	4.865	< .001
	PT4 < > AR	.273	.039	7.038	< .001
	PT4 < > GPA	.110	.039	2.829	.005**
	PT4 < > AGE	.085	.042	2.031	.042**
	PT4 < > SEX	.063	.017	3.783	< .001
	PC < > AR	.264	.039	6.808	< .001
	PC < > GPA	.157	.039	3.995	< .001
	PC < > AGE	.133	.042	3.166	.002**
	PC < > SEX	.035	.016	2.132	.033**
	AR < > GPA	.174	.039	4.414	< .001
	AR < > AGE	.098	.042	2.338	.019**
	AR < > SEX	.119	.017	6.970	< .001
	GPA < > AGE	-.008	.043	-.186	.852

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	GPA < > SEX	-.023	.017	-1.370	.171
	AGE < > SEX	.040	.018	2.171	.030**

**p < .05

Arabic Listening Variances and Covariances

Phase II

Table 206. Arabic Listening Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
19B	APT	.999	.036	27.758	< .001
19C	APT	.999	.036	27.758	< .001
	COG	.999	.036	27.758	< .001
	APT < > COG	.380	.027	13.939	< .001
19D	APT	.999	.036	27.758	< .001
	COG	.999	.036	27.758	< .001
	ATT	.999	.042	23.580	< .001
	APT < > COG	.380	.027	13.939	< .001
	APT < > ATT	.060	.030	2.009	.045**
	COG < > ATT	-.009	.030	-.300	.764

**p < .05

Phase III

Table 207. Arabic Listening Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
19E	PT3	.999	.036	27.758	< .001
19F	PT3	.999	.036	27.758	< .001
	PT2	.999	.036	27.758	< .001
	PT3 < > PT2	.223	.026	8.534	< .001
19G	PT3	.999	.036	27.758	< .001
	PT2	.999	.036	27.758	< .001
	PT1	.999	.036	27.758	< .001
	PT3 < > PT2	.223	.026	8.534	< .001
	PT3 < > PT1	.108	.026	4.200	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT2 < > PT1	.027	.025	1.060	.289
19H	PT3	.999	.036	27.758	< .001
	PT2	.999	.036	27.758	< .001
	PT1	.999	.036	27.758	< .001
	PT4	.999	.036	27.758	< .001
	PT3 < > PT2	.223	.026	8.534	< .001
	PT3 < > PT1	.108	.026	4.200	< .001
	PT3 < > PT4	.236	.026	9.031	< .001
	PT2 < > PT1	.027	.025	1.060	.289
	PT2 < > PT4	-.008	.025	-.328	.743
	PT1 < > PT4	.032	.025	1.254	.210
19I	PT3	.999	.036	27.758	< .001
	PT2	.999	.036	27.758	< .001
	PT1	.999	.036	27.758	< .001
	WK	.999	.036	27.758	< .001
	PT3 < > PT2	.223	.026	8.534	< .001
	PT3 < > PT1	.108	.026	4.200	< .001
	PT3 < > WK	.293	.027	11.044	< .001
	PT2 < > PT1	.027	.025	1.060	.289
	PT2 < > WK	.083	.026	3.256	.001**
	PT1 < > WK	.179	.026	6.920	< .001
19J	PT3	.999	.036	27.758	< .001
	PT2	.999	.036	27.758	< .001
	PT1	.999	.036	27.758	< .001
	WK	.999	.036	27.758	< .001
	PC	.999	.036	27.758	< .001
	PT3 < > PT2	.223	.026	8.534	< .001
	PT3 < > PT1	.108	.026	4.200	< .001
	PT3 < > WK	.293	.027	11.044	< .001
	PT3 < > PC	.191	.026	7.383	< .001
	PT2 < > PT1	.027	.025	1.060	.289
	PT2 < > WK	.083	.026	3.256	.001**
	PT2 < > PC	.073	.026	2.848	.004**
	PT1 < > WK	.179	.026	6.920	< .001
	PT1 < > PC	.074	.026	2.918	.004**
	WK < > PC	.441	.028	15.851	< .001
19K	PT3	.999	.036	27.758	< .001
	PT2	.999	.036	27.758	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT1	.999	.036	27.758	< .001
	WK	.999	.036	27.758	< .001
	AR	.999	.036	27.758	< .001
	PT3 < > PT2	.223	.026	8.534	< .001
	PT3 < > PT1	.108	.026	4.200	< .001
	PT3 < > WK	.293	.027	11.044	< .001
	PT3 < > AR	.222	.026	8.495	< .001
	PT2 < > PT1	.027	.025	1.060	.289
	PT2 < > WK	.083	.026	3.256	.001**
	PT2 < > AR	.088	.026	3.453	< .001
	PT1 < > WK	.179	.026	6.920	< .001
	PT1 < > AR	.058	.026	2.281	.023**
	WK < > AR	.237	.026	9.056	< .001
19L	PT2	.999	.036	27.758	< .001
	PT1	.999	.036	27.758	< .001
	WK	.999	.036	27.758	< .001
	AR	.999	.036	27.758	< .001
	MK	.999	.036	27.758	< .001
	PT2 < > PT1	.027	.025	1.060	.289
	PT2 < > WK	.083	.026	3.256	.001**
	PT2 < > AR	.088	.026	3.453	< .001
	PT2 < > MK	.065	.026	2.563	.010**
	PT1 < > WK	.179	.026	6.920	< .001
	PT1 < > AR	.058	.026	2.281	.023**
	PT1 < > MK	.027	.025	1.069	.285
	WK< > AR	.237	.026	9.056	< .001
	WK < > MK	.150	.026	5.836	< .001
	AR < > MK	.546	.029	18.818	< .001
19M	PT2	.999	.036	27.758	< .001
	PT1	.999	.036	27.758	< .001
	WK	.999	.036	27.758	< .001
	AR	.999	.036	27.758	< .001
	PT2 < > PT1	.027	.025	1.060	.289
	PT2 < > WK	.083	.026	3.256	.001**
	PT2 < > AR	.088	.026	3.453	< .001
	PT1 < > WK	.179	.026	6.920	< .001
	PT1 < > AR	.058	.026	2.281	.023**
	WK < > AR	.237	.026	9.056	< .001

**p < .05

Phase IV

Table 208. Arabic Listening Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
19N	PT2	.999	.036	27.758	<.001
	PT1	.999	.036	27.758	<.001
	WK	.999	.036	27.758	<.001
	AR	.999	.036	27.758	<.001
	GPA	.993	.037	26.913	<.001
	PT2 < > PT1	.027	.025	1.060	.289
	PT2 < > WK	.083	.026	3.256	.001
	PT2 < > AR	.088	.026	3.453	<.001
	PT2 < > GPA	.165	.026	6.265	<.001
	PT1 < > WK	.179	.026	6.920	<.001
	PT1 < > AR	.058	.026	2.281	.023**
	PT1 < > GPA	.188	.026	7.131	<.001
	WK < > AR	.237	.026	9.056	<.001
	WK < > GPA	.163	.026	6.190	<.001
	AR < > GPA	.146	.026	5.563	<.001
19O	WK	.999	.036	27.758	<.001
	GPA	.992	.037	26.896	<.001
	AGE	.998	.042	23.664	<.001
	WK < > GPA	.166	.026	6.297	<.001
	WK < > AGE	.408	.031	13.134	<.001
	GPA < > AGE	.024	.030	.802	.423
19P	WK	.999	.036	27.758	<.001
	GPA	.992	.037	26.896	<.001
	EDUC	.999	.042	23.653	<.001
	WK < > GPA	.165	.026	6.291	<.001
	WK < > EDUC	.384	.031	12.428	<.001
	GPA< > EDUC	.081	.030	2.682	.007**
19Q	WK	.999	.036	27.758	<.001
	GPA	.992	.037	26.896	<.001
	TRN_HRS	.998	.049	20.288	<.001
	WK < > GPA	.165	.026	6.289	<.001
	WK < > TRN_HRS	.007	.035	.211	.833
	GPA < > TRN_HRS	.010	.035	.273	.785

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
19R	WK	.999	.036	27.758	<.001
	GPA	.992	.037	26.896	<.001
	TRN_HRS	.998	.049	20.291	<.001
	BILLET	.250	.011	23.400	<.001
	WK < > GPA	.165	.026	6.295	<.001
	WK < > TRN_HRS	.012	.035	.343	.731
	WK < > BILLET	.008	.015	.511	.609
	GPA < > TRN_HRS	.009	.035	.271	.786
	GPA < > BILLET	-.020	.015	-1.279	.201
	TRN_HRS < > BILLET	.055	.018	3.013	.003**
19S	WK	.999	.036	27.758	<.001
	GPA	.992	.037	26.903	<.001
	TRN_HRS	.999	.049	20.291	<.001
	SEX	.206	.007	27.758	<.001
	WK < > GPA	.165	.026	6.297	<.001
	WK < > TRN_HRS	.013	.035	.368	.713
	WK < > SEX	.032	.012	2.757	.006**
	GPA < > TRN_HRS	.010	.035	.278	.781
	GPA < > SEX	-.016	.012	-1.345	.179
	TRN_HRS< > SEX	-.043	.016	-2.726	.006**

**p < .05

Arabic Reading Variances and Covariances

Phase II

Table 209. Arabic Reading Variable Variances/Covariances

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
20B	APT	1.283	.108	11.851	<.001
20C	APT	.999	.034	29.479	<.001
	COG	.999	.034	29.479	<.001
	APT < > COG	.388	.026	15.076	<.001
20D	APT	.999	.034	29.479	<.001
	COG	.999	.034	29.479	<.001
	ATT	.999	.040	24.900	<.001
	APT < > COG	.388	.026	15.076	<.001
	APT < > ATT	.052	.028	1.837	.066

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	COG < > ATT	-.009	.028	-.335	.738

**p < .05

Phase III

Table 210. Arabic Reading Variable Variances/Covariances: ASVAB and DLAB Subtests

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
20E	PT3	.999	.034	29.479	<.001
20F	PT3	.999	.034	29.479	<.001
	PT2	.999	.034	29.479	<.001
	PT3 < > PT2	.217	.025	8.835	<.001
20G	PT3	.999	.034	29.479	<.001
	PT1	.999	.034	29.479	<.001
	PT3 < > PT1	.097	.024	4.046	<.001
20H	PT3	.999	.034	29.479	<.001
	PT1	.999	.034	29.479	<.001
	PT4	.999	.034	29.479	<.001
	PT3 < > PT1	.097	.024	4.046	<.001
	PT3 < > PT4	.239	.025	9.681	<.001
	PT1 < > PT4	.038	.024	1.567	.117
20I	PT3	.999	.034	29.479	<.001
	PT1	.999	.034	29.479	<.001
	PT4	.999	.034	29.479	<.001
	WK	.999	.034	29.479	<.001
	PT3 < > PT1	.097	.024	4.046	<.001
	PT3 < > PT4	.239	.025	9.681	<.001
	PT3 < > WK	.304	.025	12.135	<.001
	PT1 < > PT4	.038	.024	1.567	.117
	PT1 < > WK	.159	.024	6.541	<.001
	PT4 < > WK	.272	.025	10.931	<.001
20J	PT3	.999	.034	29.479	<.001
	PT1	.999	.034	29.479	<.001
	PT4	.999	.034	29.479	<.001
	WK	.999	.034	29.479	<.001
	PC	.999	.034	29.479	<.001
	PT3 < > PT1	.097	.024	4.046	<.001
	PT3 < > PT4	.239	.025	9.681	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT3 < > WK	.304	.025	12.135	<.001
	PT3 < > PC	.208	.024	8.480	<.001
	PT1 < > PT4	.038	.024	1.567	.117
	PT1 < > WK	.159	.024	6.541	<.001
	PT1 < > PC	.080	.024	3.318	<.001
	PT4 < > WK	.272	.025	10.931	<.001
	PT4 < > PC	.259	.025	10.443	<.001
20K	PT3	.999	.034	29.479	<.001
	PT1	.999	.034	29.479	<.001
	PT4	.999	.034	29.479	<.001
	WK	.999	.034	29.479	<.001
	PC	.999	.034	29.479	<.001
	AR	.999	.034	29.479	<.001
	PT3 < > PT1	.097	.024	4.046	<.001
	PT3 < > PT4	.239	.025	9.681	<.001
	PT3 < > WK	.304	.025	12.135	<.001
	PT3 < > PC	.208	.024	8.480	<.001
	PT3 < > AR	.230	.025	9.338	<.001
	PT1 < > PT4	.038	.024	1.567	.117
	PT1 < > WK	.159	.024	6.541	<.001
	PT1 < > PC	.080	.024	3.318	<.001
	PT1 < > AR	.057	.024	2.389	.017**
	PT4 < > WK	.272	.025	10.931	<.001
	PT4 < > PC	.259	.025	10.443	<.001
	PT4 < > AR	.310	.025	12.334	<.001
	PC < > AR	.320	.025	12.722	<.001
20L	PT3	.999	.034	29.479	<.001
	PT1	.999	.034	29.479	<.001
	WK	.999	.034	29.479	<.001
	PC	.999	.034	29.479	<.001
	AR	.999	.034	29.479	<.001
	MK	.999	.034	29.479	<.001
	PT3 < > PT1	.097	.024	4.046	<.001
	PT3 < > WK	.304	.025	12.135	<.001
	PT3 < > PC	.208	.024	8.480	<.001
	PT3 < > AR	.230	.025	9.338	<.001
	PT3 < > MK	.194	.024	7.955	<.001
	PT1 < > WK	.159	.024	6.541	<.001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*P*
	PT1 < > PC	.080	.024	3.318	<.001
	PT1 < > AR	.057	.024	2.389	.017
	PT1 < > MK	.021	.024	.861	.389
	WK < > PC	.455	.026	17.260	<.001
	WK < > AR	.249	.025	10.090	<.001
	WK < > MK	.160	.024	6.606	<.001
	PC < > AR	.320	.025	12.722	<.001
	PC < > MK	.197	.024	8.054	<.001
	AR < > MK	.544	.027	19.925	<.001

**p < .05

Phase IV

Table 211. Arabic Reading Variable Variances/Covariances: Other Predictors

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
20M	PT3	.999	.034	29.479	< .001
	PT1	.999	.034	29.479	< .001
	WK	.999	.034	29.479	< .001
	PC	.999	.034	29.479	< .001
	AR	.999	.034	29.479	< .001
	MK	.999	.034	29.479	< .001
	GPA	1.013	.035	28.590	< .001
	PT3 < > PT1	.097	.024	4.046	< .001
	PT3 < > WK	.304	.025	12.135	< .001
	PT3 < > PC	.208	.024	8.480	< .001
	PT3 < > AR	.230	.025	9.338	< .001
	PT3 < > MK	.194	.024	7.955	< .001
	PT3 < > GPA	.242	.025	9.551	< .001
	PT1 < > WK	.159	.024	6.541	< .001
	PT1 < > PC	.080	.024	3.318	< .001
	PT1 < > AR	.057	.024	2.389	.017
	PT1 < > MK	.021	.024	.861	.389
	PT1 < > GPA	.182	.025	7.266	< .001
	WK < > PC	.455	.026	17.260	< .001
	WK < > AR	.249	.025	10.090	< .001
	WK < > MK	.160	.024	6.606	< .001
	WK < > GPA	.156	.025	6.255	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PC < > AR	.320	.025	12.722	< .001
	PC < > MK	.197	.024	8.054	< .001
	PC < > GPA	.107	.025	4.317	< .001
	AR < > MK	.544	.027	19.925	< .001
	AR < > GPA	.137	.025	5.524	< .001
	MK < > GPA	.140	.025	5.627	< .001
20N	WK	.999	.034	29.479	< .001
	PC	.999	.034	29.479	< .001
	AR	.999	.034	29.479	< .001
	MK	.999	.034	29.479	< .001
	GPA	1.011	.035	28.574	< .001
	AGE	1.003	.040	25.020	< .001
	WK < > PC	.455	.026	17.260	< .001
	WK < > AR	.249	.025	10.090	< .001
	WK < > MK	.160	.024	6.606	< .001
	WK < > GPA	.158	.025	6.318	< .001
	WK < > AGE	.410	.029	13.987	< .001
	PC < > AR	.320	.025	12.722	< .001
	PC < > MK	.197	.024	8.054	< .001
	PC < > GPA	.107	.025	4.323	< .001
	PC < > AGE	.262	.028	9.229	< .001
	AR < > MK	.544	.027	19.925	< .001
	AR < > GPA	.139	.025	5.599	< .001
	AR < > AGE	.215	.028	7.638	< .001
	MK < > GPA	.140	.025	5.645	< .001
	MK < > AGE	.049	.028	1.785	.074
	GPA < > AGE	.014	.028	.480	.631
20O	WK	.999	.034	29.479	< .001
	PC	.999	.034	29.479	< .001
	AR	.999	.034	29.479	< .001
	MK	.999	.034	29.479	< .001
	GPA	1.011	.035	28.573	< .001
	EDUC	1.003	.040	24.993	< .001
	WK < > PC	.455	.026	17.260	< .001
	WK < > AR	.249	.025	10.090	< .001
	WK < > MK	.160	.024	6.606	< .001
	WK < > GPA	.157	.025	6.302	< .001
	WK < > EDUC	.384	.029	13.139	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PC < > AR	.320	.025	12.722	< .001
	PC < > MK	.197	.024	8.054	< .001
	PC < > GPA	.107	.025	4.323	< .001
	PC < > EDUC	.250	.028	8.795	< .001
	AR < > MK	.544	.027	19.925	< .001
	AR < > GPA	.139	.025	5.594	< .001
	AR < > EDUC	.177	.028	6.317	< .001
	MK < > GPA	.141	.025	5.651	< .001
	MK < > EDUC	.073	.028	2.630	.009**
	GPA < > EDUC	.071	.029	2.489	.013**
20P	WK	.999	.034	29.479	< .001
	PC	.999	.034	29.479	< .001
	AR	.999	.034	29.479	< .001
	MK	.999	.034	29.479	< .001
	GPA	1.011	.035	28.573	< .001
	TRN_HRS	1.003	.047	21.345	< .001
	WK < > PC	.455	.026	17.260	< .001
	WK < > AR	.249	.025	10.090	< .001
	WK < > MK	.160	.024	6.606	< .001
	WK < > GPA	.157	.025	6.301	< .001
	WK < > TRN_HRS	.029	.033	.877	.380
	PC < > AR	.320	.025	12.722	< .001
	PC < > MK	.197	.024	8.054	< .001
	PC < > GPA	.107	.025	4.334	< .001
	PC < > TRN_HRS	.039	.033	1.189	.235
	AR < > MK	.544	.027	19.925	< .001
	AR < > GPA	.139	.025	5.580	< .001
	AR < > TRN_HRS	-.061	.033	-1.852	.064
	MK < > GPA	.141	.025	5.653	< .001
	MK < > TRN_HRS	-.029	.033	-.864	.388
	GPA < > TRN_HRS	-.001	.034	-.037	.971
20Q	WK	.999	.034	29.479	< .001
	PC	.999	.034	29.479	< .001
	AR	.999	.034	29.479	< .001
	MK	.999	.034	29.479	< .001
	GPA	1.011	.035	28.574	< .001
	TRN_HRS	1.004	.047	21.347	< .001
	BILLET	.250	.010	24.627	< .001

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	WK < > PC	.455	.026	17.260	< .001
	WK < > AR	.249	.025	10.090	< .001
	WK < > MK	.160	.024	6.606	< .001
	WK < > GPA	.157	.025	6.296	< .001
	WK < > TRN_HRS	.032	.033	.978	.328
	WK < > BILLET	.014	.014	.972	.331
	PC < > AR	.320	.025	12.722	< .001
	PC < > MK	.197	.024	8.054	< .001
	PC < > GPA	.107	.025	4.332	< .001
	PC < > TRN_HRS	.041	.033	1.228	.219
	PC < > BILLET	.009	.014	.658	.510
	AR < > MK	.544	.027	19.925	< .001
	AR < > GPA	.139	.025	5.579	< .001
	AR < > TRN_HRS	-.060	.033	-1.820	.069
	AR < > BILLET	-.022	.014	-1.507	.132
	MK < > GPA	.140	.025	5.644	< .001
	MK < > TRN_HRS	-.027	.033	-.804	.421
	MK < > BILLET	-.017	.014	-1.180	.238
	GPA < > TRN_HRS	-.002	.034	-.050	.960
	GPA < > BILLET	-.015	.015	-1.008	.313
	TRN_HRS < > BILLET	.050	.017	2.863	.004**
20R	WK	.999	.034	29.479	< .001
	PC	.999	.034	29.479	< .001
	AR	.999	.034	29.479	< .001
	MK	.999	.034	29.479	< .001
	GPA	1.011	.035	28.576	< .001
	TRN_HRS	1.003	.047	21.347	< .001
	SEX	.205	.007	29.479	< .001
	WK < > PC	.455	.026	17.260	< .001
	WK < > AR	.249	.025	10.090	< .001
	WK < > MK	.160	.024	6.606	< .001
	WK < > GPA	.157	.025	6.307	< .001
	WK < > TRN_HRS	.031	.033	.947	.344
	WK < > SEX	.040	.011	3.683	< .001
	PC < > AR	.320	.025	12.722	< .001
	PC < > MK	.197	.024	8.054	< .001
	PC < > GPA	.108	.025	4.343	< .001
	PC < > TRN_HRS	.039	.033	1.199	.231

Model	Variable(s) of Interest	Estimate	*SE*	*C.R.*	*p*
	PC < > SEX	.049	.011	4.474	< .001
	AR < > MK	.544	.027	19.925	< .001
	AR < > GPA	.139	.025	5.591	< .001
	AR < > TRN_HRS	-.058	.033	-1.748	.080
	AR < > SEX	.100	.011	9.018	< .001
	MK < > GPA	.141	.025	5.657	< .001
	MK < > TRN_HRS	-.026	.033	-.781	.435
	MK < > SEX	.044	.011	4.081	< .001
	GPA < > TRN_HRS	.001	.034	.042	.967
	GPA < > SEX	-.022	.011	-1.927	.054
	TRN_HRS < > SEX	-.043	.015	-2.845	.004**

**p < .05

Table 212. Correlations: Predictor Variables

	DLAB	DLAB_PT1	DLAB_PT2	DLAB_PT3	DLAB_PT4	ASVAB	ASVAB_AR	ASVAB_WK	ASVAB_PC	ASVAB_MK	GPA	AGE	TRN_HRS	ATT
DLAB	--													
DLAB_PT1	.307**	--												
DLAB_PT2	.501**	.039**	--											
DLAB_PT3	.836**	.141**	.257**	--										
DLAB_PT4	.639**	.103**	.062**	.268**	--									
ASVAB	.401**	.130**	.106**	.309**	.360**	--								
ASVAB_AR	.359**	.079**	.115**	.255**	.352**	.673**	--							
ASVAB_WK	.322**	.152**	.080**	.266**	.249**	.683**	.210**	--						
ASVAB_PC	.264**	.109**	.077**	.187**	.245**	.641**	.299**	.471**	--					
ASVAB_MK	.334**	.070**	.089**	.275**	.289**	.571**	.566**	.106**	.175**	--				
GPA	.237**	.215**	.125**	.223**	.062**	.140**	.122**	.109**	.088**	.153**	--			
AGE	.145**	.237**	.065**	.055**	.121**	.222**	.118**	.333**	.208**	-.008	.033**	--		
TRN_HRS	.000	.007	.000	.017	-.025	-.037*	-.070**	.010	.004	-.048**	-.012	.050**	--	
ATT	.153**	.092**	.070**	.153**	.054**	.043**	-.012	.085**	.060**	.005	.136**	.054**	.069**	--

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

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