



Enhancing General and Language Aptitude Tests by Incorporating Cultural and Emo-Sensory Constructs

Reza Pishghadam^{1a,b}, Taqi Al Abdwani^{2c}, Haniyeh Jajarmi^{3d}, Shaghayegh Shayesteh^{4a}

ARTICLE HISTORY:

Received February 2023
Received in Revised form April 2023
Accepted May 2023
Available online May 2023

KEYWORDS:

General aptitude
Language aptitude
Aptitude tests
Culture
Education

Abstract

Aptitude testing is a valuable tool for assessing individuals' potential and predicting their performance in various settings. However, current tests may not fully capture individuals' range of abilities and tend to focus on specific cognitive constructs, ignoring non-cognitive ones. To address this gap, this article suggests incorporating cultural and emo-sensory constructs into general and foreign language aptitude testing. The newly developed Pishghadam Language-based General Aptitude Test (PL-GAT) measures a wide range of cognitive abilities, including attention, verbal and nonverbal reasoning, memory, and critical thinking, along with non-cognitive abilities, such as emotion, culture, and sense. Concurrently, this dual-purpose test provides an evaluation of individuals' foreign language aptitude as well. The integration of these constructs provides a more accurate and comprehensive assessment of individuals' potential, allowing them to understand their strengths and weaknesses better. Additionally, organizations can make more informed decisions when selecting candidates for academic or career purposes.

¹ Professor, Email: pishghadam@um.ac.ir (Corresponding Author)
Tel: +98-51-38807654

² Professor, Email: proftaki@gulfcollege.edu.om

³ Assistant Professor, Email: hjajarmi@baharihe.ac.ir

⁴ Assistant Professor, Email: shayesteh@um.ac.ir

^a Ferdowsi University of Mashhad, Iran

^b Pishghadam Testing and Language Aptitude Measurement Center, Ferdowsi University of Mashhad, Iran

^c Gulf College, Oman

^d Bahar Institute of Higher Education, Iran

<http://dx.doi.org/10.22034/ijsc.2023.704891>

© 2023 Pishghadam, Al Abdwani, Jajarmi, and Shayesteh.

This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY).

1. Introduction

Since the development of aptitude tests, they have been used for different predictive purposes, including career guidance, educational achievement, or employee selection (Cohen & Swerdlik, 2018; Popham, 1999; Salkind & Rasmussen, 2007). Aptitude tests measuring cognitive abilities attempt to determine individuals' potential to achieve specific tasks in the future, helping them to take the right path to success (Nugba & Quansah, 2021). Research has shown that merely using aptitude tests for achieving the abovementioned purposes is far from comprehensive and requires other instruments to measure non-cognitive abilities as well. That is why aptitude tests are suggested to be combined with non-cognitive instruments for making more appropriate decisions (Hansen & Dettmer, 2015).

While cognitive abilities include verbal, numerical, or spatial reasoning, which may show the thinking abilities of individuals, non-cognitive abilities focus on personality traits, motivation, interests, or values, which may indicate the socio-emotional skills of individuals (Demetriou et al., 2019). Thus, to predict the right course of action in the future, one has to take several instruments to show their full potential. The problem with using a number of tests is that they may be time-consuming and burdensome, affecting tests' validity and reliability. Moreover, the prediction may be faulty since no specific model guides psychologists or educationalists on what non-cognitive factors to include or exclude.

As mentioned, a full-fledged model may be required to determine what tests should be used to measure general or foreign language aptitude. In this study, we intend to introduce Pishghadam Language-based General Aptitude Test (PL-GAT) developed by Pishghadam Testing and Language Aptitude Measurement Center (2023). This test was designed to measure cognitive and non-cognitive dimensions of general aptitude, as well as foreign language aptitude, based on the Brainling model, which incorporates cognitive, cultural, emotional, and sensory experiences as its components (Pishghadam, 2020). The model takes into account the complexity and diversity of human cognition and suggests that the brain's macro functions play a critical role in multiple cognitive

and non-cognitive domains (Pishghadam & Ebrahimi, 2020).

In what follows, a review of the literature pertaining to general aptitude and foreign language aptitude testing will be presented, culminating with the introduction of PL-GAT in the conclusion of this paper.

2. General Aptitude

General aptitude refers to an individual's overall ability to learn and perform well in various academic and professional settings (Nugba & Quansah, 2021). It is generally established as a set of cognitive abilities that include reasoning, problem-solving, and critical thinking, as well as numerical and verbal skills. Essentially, a person with a high general aptitude is able to swiftly adjust to new conditions, develop new skills, and solve complicated problems efficiently (Popham, 1999).

Accordingly, the current general aptitude testing deals with a type of assessment that measures an individual's cognitive abilities. Aptitude tests inform us about a student's abilities and skills that they possess, irrespective of the particular educational program they have already undergone (Macklem, 1990). These tests are generally designed to predict the students' performance in a future educational setting (Popham, 1999). In other words, the students' educational prospects are determined by how they perform on the test that everyone else takes in precisely the same circumstances and manner, regardless of where the exam is administered (Sanam Khan, 2019). In addition to situating students in their educational settings (Bennett, 2015; Venezia & Jaeger, 2013), the results of aptitude tests can provide valuable insights into an individual's strengths and weaknesses, helping them to make informed decisions about their career paths (Cohen & Swerdlik, 2018; Salkind & Rasmussen, 2007).

Many studies investigating general aptitude have conclusively suggested that cognitive abilities are a significant determinant of a person's success in academic performance (e.g., Chong & Yeo, 2016; Demetriou et al., 2019; Demetriou et al., 2020; Mandelman et al., 2016; Rajalaxmi et al., 2019). However, contrary to previously published studies,

Garrett (2022) argued that the existing aptitude tests (e.g., the Law School Admission Test (LSAT) and the Medical College Admission Test (MCAT)), not only fail to predict academic success but also rarely reflect real achievement in the relevant domains of the career. He believed that such exams only test candidates on skills such as reading comprehension, reasoning, problem-solving, and critical thinking while they neglect the important skills necessary for the future job, such as awareness of human psychology and motivation.

Moreover, a review of the related literature shows that prior studies have not been able to account for all aspects of an individual's general aptitude, mainly their non-cognitive abilities. Non-cognitive abilities are related to academic and occupational skills, which are not specifically analytical or intellectual in nature (Rosen et al., 2010). Previous research has shown that non-cognitive attributes have a significant and durable effect on success in life (e.g., Farkas, 2003; Rauber, 2007). They play a crucial role in limiting the deficiencies in cognitive development and improving academic achievement (Rosen et al., 2010). However, in the education literature, non-cognitive skills are not captured properly by the current standardized tests (Humphries & Kosse, 2017).

On the other hand, the current aptitude tests only measure one learning style and ignore the visual, auditory, reading/writing, and kinesthetic learning styles, Known as the VARK model (Prithishkumar & Michael, 2014). Based on this model, individuals have different sensory modality preferences in learning and processing information, which need to be considered in order to identify their abilities in performing different types of tasks. Accordingly, each specific sensory modality preference requires a different mode of testing to assess the individuals' performance and adequacy, whereas the currently administered aptitude tests have failed to show that convincingly.

Overall, general aptitude testing can be a useful tool for individuals seeking to understand their cognitive abilities and employers looking to identify candidates with the right skills for specific roles. However, it is important to note that aptitude tests should not be used as the sole basis for making decisions about an individual's future. It is also important to

underline that aptitude tests measure the candidates' present skills and abilities in the existing condition (Nugba & Quansah, 2021). Therefore, the concept of aptitude does not imply that it is inherited or acquired or denote some mixture of environmental and hereditary factors (Miller et al., 2009). Popular examples of general aptitude testing are the Scholastic Aptitude Test (SAT), the Graduate Record Examination (GRE), the American College Testing (ACT), and the Graduate Management Admission Test (GMAT), which are mostly used for academic purposes. Moreover, General Aptitude Test Battery (GATB) and the Armed Services Vocational Aptitude Battery (ASVAB) are among the aptitude tests mainly used for career guidance or employee selection purposes.

2.1. The Scholastic Aptitude Test (SAT)

The SAT has been created and administered by the partnership of the Educational Testing Service (ETS) and the College Entrance Examination Board (CEEB; Becker, 1990; Slack & Porter, 1980). In academic circles, there was a lot of focus on SAT performance during the 1980s. It has been regarded as the benchmark for maintaining the standard of students' abilities, and it has also been acknowledged as a significant means of providing equal opportunities in American higher education (Atkinson, 2001). Moreover, many researchers measure cognitive abilities with the SAT. It is a standardized test that colleges and universities around the globe use to determine if a student is prepared for college-level study (Muhid et al., 2020). The SAT consists of two main sections: Evidence-Based Reading and Writing, and Math. The Evidence-Based Reading and Writing section includes reading comprehension questions, grammar and vocabulary questions, and an optional essay. The Math section includes both multiple-choice questions and grid-in questions that require students to solve problems without answer choices provided.

2.2. The Graduate Record Examination (GRE)

The GRE has played a significant role in admission decisions for many departments. The GRE, developed and published by the Educational Testing Service (ETS), is a set of standardized tests designed to predict the academic performance of graduate students. It includes tests of verbal, quantitative, and

analytical abilities, as well as subject area knowledge for various fields (Kuncel et al., 2001).

The GRE was specifically created to assess the fundamental skills that are important for succeeding in graduate-level academic performance (Briel et al., 1993). The test items reflect long-term learning of material that relates to graduate-level performance. On the General Test, test takers are required to solve problems, synthesize information, and analyze complex relationships between pieces of information. The Verbal measure (GRE-V) includes analogy, antonym, sentence completion, and reading comprehension questions. The Quantitative measure (GRE-Q) consists of discrete quantitative, quantitative comparison, and data interpretation questions. The Analytical measure (GRE-A) includes analytical reasoning and logical reasoning items. The Subject Tests assess knowledge acquired in specific fields of study, such as biology, chemistry, or psychology (Briel et al., 1993).

Overall, there are six sections (i.e., Analytical Writing (one section with two separately timed tasks), Verbal Reasoning (two sections), and Quantitative Reasoning (two sections)) with a 10-minute break which follows the third section. The GRE is usually conducted on a computer; however, a paper-based test may be provided in locations without the necessary computer networks (Powers, 2001).

2.3. The American College Testing (ACT)

The ACT is another prevalent standardized aptitude test that is used for college admissions in the United States (Qiu & Wu, 2011). It is a pencil-and-paper multiple-choice test developed and administered by ACT, Inc. (ACT, 2005). It measures student's knowledge and skills in four subject areas: English, mathematics, reading, and science (Coyle, 2015). The composite score is calculated by taking the mean of the scores of the four subject areas (Qiu & Wu, 2011). In addition to the standard ACT test, there is also an optional essay section. Some colleges may require or recommend that students take this optional section.

2.4. The Graduate Management Admission Test (GMAT)

The GMAT, developed in 1954 by the Graduate Management Admission Council (GMAC), is a

commonly used tool for predicting the performance of business students (Sireci & Talento-Miller, 2006). The skills measured by the GMAT have significant overlap with the skills required for success in business studies. Additionally, students with prior knowledge and skills in a specific domain are generally better equipped to acquire further knowledge and skills in that domain (Kuncel et al., 2007).

The GMAT assesses a test-taker's analytical writing, quantitative reasoning, verbal reasoning, and critical thinking skills. The exam consists of four sections: Analytical Writing Assessment, Integrated Reasoning, Quantitative Reasoning, and Verbal Reasoning (Sireci & Talento-Miller, 2006). It is worth noting that the GMAT is a computer-adaptive test (CAT), meaning that the level of difficulty of each question is determined by the test-taker's performance on previous questions. Therefore, two individuals who respond to different sets of questions can achieve the same score if they perform equally well (Runder, 2009).

2.5. General Aptitude Test Battery (GATB)

The GATB (United States Department of Labor, 1967) is a multiple-choice, general aptitude speed test designed to screen and evaluate individuals' cognitive abilities in relation to work (Farrell & McDaniel, 2001). It has been widely utilized in the United States and other countries to forecast the productivity of employees in both private and government jobs (Johari & Jha, 2020). The test has been subjected to validity studies on numerous occupations (Bemis, 1968).

The GATB assesses nine aptitudes, as described by Johari and Jha (2020). These are first, Aptitude G, which measures a worker's ability to understand instructions and underlying principles and to use logical reasoning in decision-making. Second, Aptitude V, which assesses a worker's ability to understand and derive meaning from words in order to use them effectively. Third, Aptitude N, which assesses a worker's ability to quickly and accurately solve numerical problems. Fourth, Aptitude S, which evaluates a worker's ability to identify meaningful relationships among objects in space. Fifth, Aptitude P, which measures a worker's ability to understand and comprehend the details of an object or graphical material and to visually

compare and discriminate between shapes and shading. Sixth, Aptitude Q, which evaluates a worker's speed of perception and ability to perceive differences in words and numbers in verbal or tabular form. Seventh, Aptitude K, which highlights the coordination among eyes, hands, and fingers, which helps a worker make accurate and swift movements while working at a reasonable speed. Eighth, Aptitude F, which evaluates a worker's ability to manipulate small objects rapidly and accurately using finger movements. Ninth, Aptitude M, which assesses manual dexterity and enables workers to use their hands quickly and skillfully to place and turn objects during an activity.

2.6. The Armed Services Vocational Aptitude Battery (ASVAB)

Each year in the United States, the ASVAB (Department of Defense, 1984) is administered to more than one million individuals, either as a screening test for military recruits or as a counseling tool in high schools (Kyllonen, 1993). According to Roberts et al. (2000), this 3-hour, 10-test multiple-aptitude battery was initially used as a classification tool, which was constructed without any apparent coherent factorial structure. The main reason was that the tests were chosen based on their perceived similarity to the military occupations rather than any theories of psychology.

As explained by Roberts et al. (2000), the ten subtests that make up the ASVAB are, first, the General Science test, including 25 questions that assess knowledge of scientific facts. Second, the Arithmetic Reasoning test consists of 30 word problems that require arithmetic calculations. Third, the Word Knowledge test, which has 35 vocabulary questions based on commonly used words. Fourth, the Paragraph Comprehension test, in which participants read 15 paragraphs, each one to three sentences long, and answer a multiple-choice question about the content. Fifth, the Numerical Operations test which is a 10-minute timed test with 50 simple math fact questions. Sixth, the Coding Speed test is another 10-minute timed test with 84 items that require participants to match a word to a corresponding number code and select the letter associated with that code. Seventh, the Autoshop test which includes 25 questions about automobiles, shop practices, and the proper use of mechanical tools. Eighth, the Mathematics Knowledge test consists of 25

mathematical problems. Ninth, the Mechanical Comprehension test with 25 questions that are related to general mechanical and physical principles and are often accompanied by drawings. Tenth, the Electrical Information test containing 20 questions that assess knowledge of radio, electrical, and electronic information (Roberts et al., 2000).

3. Foreign Language Learning Aptitude

Foreign language learning aptitude has been a widely researched individual difference variable in second language acquisition (SLA) studies since the early 1960s. Extensive research in the field has demonstrated that foreign language learning aptitude accounts for a considerable portion of the variation in foreign language learning achievement and proficiency (Dörnyei & Skehan, 2003; Rysiewicz, 2008).

In general, foreign language learning aptitude is defined as a collection of inherent abilities and predispositions that an individual possesses prior to learning a new language (Dörnyei, 2005). These abilities and traits may influence the individual's potential level of achievement in the language to some extent. Carroll (1973, 1981) has suggested that the amount of time required to achieve a certain level of proficiency is related to foreign language aptitude. Essentially, he believes that almost anyone can learn a second language, given appropriate instruction, motivation, and the ability to benefit from the instruction. Yet, similar to general aptitude, foreign language aptitude was considered to be a cognitive ability, with little attention paid to its non-cognitive aspects.

The classical model of language aptitude was created by Carroll and Sapon (1959) through a series of factor analysis studies on various abilities believed to be significant in foreign language learning. This resulted in a four-component model that identified and interpreted the following abilities. Firstly, phonemic coding ability, which pertains to the capacity to break down and recognize distinct foreign sounds, associating them with corresponding written symbols and utilizing them later on. Secondly, grammatical sensitivity, which involves recognizing the grammatical roles of words or phrases within sentences. Thirdly, inductive language learning ability,

which is associated with deducing linguistic patterns and rules based on a limited amount of linguistic input, such as a made-up language. Finally, rote learning ability, which deals with creating connections between the meaning and form of language material presented visually, retaining these connections, and recalling the associated meanings later on.

Later, based on the findings from cognitive psychology, Skehan (1998) updated the concept of language aptitude and proposed a three-part structure. The first part was phonemic coding ability, which was the same as Carroll's original proposal. The second part was language analytic ability, defined as the ability to recognize language patterns, produce new language chunks, and apply new internalized language rules. It was the integration of Carroll's grammatical sensitivity and inductive language learning analytic ability. The third component was the memory, which Carroll had described as associative memory, but Skehan (1998) emphasized the need to efficiently retrieve information in real-time to handle conversational demands, similar to the current understanding of working memory.

Carroll's empirically-derived four-component model of foreign language (FL) aptitude served as the foundation for the development of the Modern Language Aptitude Test (Carroll & Sapon, 1959). Besides MLAT, the commonly recognized tests designed to measure language aptitude in English-speaking adults are the Pimsleur Language Aptitude Battery (PLAB, Pimsleur 1966), CANAL-F Theory (Cognitive Ability for the Novelty in Acquisition of Language – Foreign; Grigorienko et al., 2000), and The LLAMA Test (Meara, 2005). Pishghadam Language Aptitude Test (PLAT) has also been introduced to the field recently.

3.1. Modern Language Aptitude Test (MLAT)

The 64-year-old MLAT has been referenced in numerous articles published in prestigious journals since it was first published in 1959. It has been utilized as a means of collecting data in multiple research studies and has been embraced as the most accurate assessment tool for selection purposes by various educational and research institutions (Carroll et al., 2010; Rysiewicz, 2008; Sasaki, 2012).

To effectively measure the four mentioned components of Carroll's foreign language

aptitude model, five specific performance tasks were developed. The first task, "Number learning", measures memory by requiring learners to learn and translate unfamiliar language numbers. The second task, "Phonetic script", assesses phonetic coding ability by evaluating the correlation between phonetic symbols and sounds. The third task, "Spelling clues", evaluates English vocabulary knowledge and phonetic coding ability by presenting reduced English words. The fourth task, "Words in sentences", assesses grammatical sensitivity by presenting a pair of English sentences with an underlined word. Finally, the fifth task, "Paired associates", measures rote learning ability for foreign language materials by requiring learners to memorize English meanings for unfamiliar language words. These tasks provide a comprehensive evaluation of foreign language aptitude and help researchers better understand the different factors that contribute to successful language learning.

Upon a quick examination of the MLAT, two issues arise regarding how the battery employs Carroll's four-component model. Firstly, not all four factors of the model are present in the tasks, and secondly, certain components are better represented than others. Out of the four abilities proposed in the Carroll model, parts 2, 4, and 5 adequately represent phonetic coding, grammatical sensitivity, and rote learning, respectively, while parts 3 and 1 only weakly represent phonetic coding, rote learning, and inductive learning, respectively. Specifically, inductive learning receives minimal representation in the "Number learning" task; grammatical sensitivity is represented well in one task, while the remaining two components, phonetic coding, and rote learning, appear twice in two tasks- phonetic coding in "Phonetic script" and "Spelling clues", and rote learning in "Paired associates" and "Number learning" (Rysiewicz, 2008).

3.2. Pimsleur Language Aptitude Battery (PLAB)

Another test that measures foreign language learning aptitude is PLAB (Pimsleur, 1968). While Pimsleur's approach is somewhat similar to that of Carroll and Sapon's, his is narrower, focusing on language analytic and auditory abilities as the two primary components of foreign language learning aptitude. In addition

to these components, PLAB also includes questions about the student's interests (Part 1) and their academic grades in English, Mathematics, History, and Science (Part 2). Pimsleur's view is that cognitive factors like academic achievement and personality factors like motivation/attitude both play a role in FL aptitude. The remaining parts of PLAB include Vocabulary (Part 3), which tests a person's knowledge of their native language vocabulary; Language Analysis (Part 4), which measures the ability to learn a language inductively through rule inference; Sound Discrimination (Part 5), which evaluates the capacity to concentrate on new foreign language auditory material; and Sound-Symbol Association (Part 6) which tests the ability to perform phonetic coding tasks.

Pimsleur believes that foreign language aptitude is defined by cognitive abilities related to sound identification, meaning coding, and inductive rule acquisition, as well as L1 vocabulary knowledge and motivation. However, Pimsleur himself seems to exclude motivation from the discussion of his battery's uses (Rysiewicz, 2008).

3.3. CANAL-F Theory (Cognitive Ability for the Novelty in Acquisition of Language - Foreign)

Grigorienco et al. (2000) devised a new test to measure foreign language aptitude. This test is based on the CANAL-F Theory, which is a cognitive theory of foreign language acquisition. The main principle of this theory is that the ability to handle ambiguity and novelty is a key requirement for learning a foreign language. The authors suggest that their CANAL-F theory has four main components, including knowledge acquisition processes, levels of processing, modes of input, and memory processes. These components are centered around acquisition processes rather than the products of these processes. During knowledge acquisition, the learner uses several processes, such as selective encoding, accidental encoding, selective comparison, selective transfer, and selective combination. Selective encoding distinguishes relevant from irrelevant information, while accidental encoding encodes less important information. Selective comparison determines old information's relevance to current tasks, and selective transfer applies inferred rules to new tasks. Selective

combination synthesizes new and old information. Grigorienco et al. (2000) claim that the test is unique because it simulates continuous learning and assesses knowledge acquisition processes during the test.

3.4. The LLAMA Test

The LLAMA, a free and quick language aptitude test, has become a popular alternative to the classic MLAT since its release in 2005 (Meara, 2005). The LLAMA aptitude test combines traditional and modern approaches, which mostly focus on explicit and implicit learning abilities, respectively. The traditional components, which were inspired by the MLAT (Meara, 2005), include tasks that involve remembering associated words and making inferences about grammar. Moreover, the LLAMA test includes a new component that involves recognizing sequences. This type of test, which has been used to measure implicit learning abilities, is not typically included in traditional aptitude tests. The LLAMA battery comprises four subtests, namely LLAMA B, which evaluates the acquisition of new vocabulary; LLAMA D, which assesses the ability to recognize spoken language patterns; LLAMA E, which measures the capacity to form associations between sounds and symbols; and LLAMA F which examines the capability of deriving grammar rules from a restricted number of examples. Although over the past few years, the test has been used in more than 40 studies, the internal validity of the LLAMA test battery is still under question (Bokander & Bylund, 2019).

3.5. Pishghadam Language Aptitude Test (PLAT)

PLAT is used to measure language aptitude in adults. The test was developed and validated by the Pishghadam Testing and Language Aptitude Measurement Center in 2020. The test consists of 40 items, which are divided into four categories: Numbers, Words, Sentences, and Invented Language. Each category has ten items that assess different aspects of language aptitude, such as the ability to memorize vocabulary and learn a new language. The overall reliability of the test, which refers to the consistency of results over time, was reported as .92 using Cronbach's alpha.

4. PL-GAT as A New Test with Cognitive, Cultural, and Emo-Sensory Components

As already mentioned, general aptitude tests primarily measure cognitive abilities, including memory, problem-solving, and reasoning, ignoring non-cognitive abilities such as emotional intelligence, sensory experiences, and cultural awareness. Moreover, these tests use figures, numbers, and questions to measure cognitive abilities. To remedy these issues, Pishghadam Testing and Language Aptitude Measurement Center developed and validated a comprehensive Persian aptitude test named PL-GAT (2023), targeting to measure non-cognitive as well as cognitive abilities. Another distinctive feature of PL-GAT is that it measures individuals' general aptitude via the use of language.

The test is carried out in two phases: subjective and objective. The subjective phase includes picture description in which the applicant selects two pictures from among 20 pictures, which are related to different disciplines, including math and engineering, science, humanities, vocational skills, and art. Subsequent to the selection of their favorite pictures, the applicant describes one picture orally and the other in a written format. The objective phase has 66 multiple-choice or short-answer items designed based on the Brainling model (Pishghadam, 2020). This model consists of four components, namely cogling (cognition and language), emoling (emotion and language), cultuling (culture and language), and sensoling (sense and language) (Pishghadam, 2020; Pishghadam & Ebrahimi, 2020).

Based on the Brainling model, PL-GAT is composed of four sub-constructs, each of which includes its pertaining components. More explicitly, cogling measures individuals' cognitive abilities, including attention, memory, verbal reasoning, non-verbal reasoning, and critical thinking via 30 items with six items designated to each of the components. Emoling, as the next sub-construct of PL-GAT, assesses the individuals' interemotions and intraemotions by means of 12 items (i.e., six items for each). Considering the crucial role of emotions in human life (Damasio, 2001), interemotions refer to the ability to understand others' emotions (positive or negative) underlying the language which is used in conversations. On the other hand, intraemotions refer to the ability of

individuals to identify their own language-induced emotions emerging as a result of encountering different words, phrases, and sentences in the communication process. Cultuling, the third sub-construct of PL-GAT, also consists of 12 items measuring Culture (Big C) and culture (Little c), with six items for each. Big C Culture refers to a society's literature (poems, novels, etc.), music, and art, and Little c culture refers to individuals' everyday life, values, customs, beliefs, and behavior (Kramersch, 2013; Peterson, 2004). Finally, sensoling, the last sub-construct of PL-GAT, gauges individuals' ability to process information via their senses. It includes a total of 12 items that pertain to the six senses of auditory, visual, tactile, kinesthetic, smell, and taste, with two items allocated to each sense.

Overall, PL-GAT evaluates both cognitive and non-cognitive abilities of individuals over the age of 14, using language as the medium for assessment. The test's reliability was determined to be high, with a Cronbach's alpha value of .91.

5. Concluding Remarks

Overall, the reviews indicate that general and foreign language aptitude tests have conventionally focused on cognitive abilities as the key predictors of success in many areas of life, while non-cognitive elements have been largely disregarded. Research has shown that non-cognitive elements such as culture, emotion, and sense, among others, can significantly impact one's performance, yet have often been overlooked in traditional aptitude tests. It is indeed believed that, just like intelligence which is a complex and multi-dimensional concept with different types, aptitude can also be categorized into different types, depending on the type of task or skill being measured. By categorizing aptitude into different types, it becomes easier to identify individuals' strengths and weaknesses and match them with tasks, majors, or careers that align with their natural abilities. This can be helpful in educational settings, career development, and even personal growth, as it can provide insights into areas where an individual may need to improve.

Such a comprehensive approach toward aptitude has been adopted by the developers of PL-GAT. Based on the Brainling model, PL-GAT covers not only cognitive but cultural and

emo-sensory aspects of aptitude as well. This holistic approach toward aptitude has the potential to revolutionize various fields by providing a more personalized and effective experience. It can also help individuals unlock their full potential and achieve their goals in various fields.

A further exclusive feature of PL-GAT is that it serves a dual purpose. The items have been developed in such a way as to measure both the general and foreign language aptitude of the individuals simultaneously. For instance, a task that requires logical reasoning may also involve a foreign language component, such as translating a sentence from one language to another. This way, the test can provide a comprehensive evaluation of an individual's abilities in both areas.

Last but not least, one point which is highly important and should be taken into consideration while we attempt to predict and measure one's aptitude is that it is not a static concept. It means when you determine one's aptitude you need to go further to come up with more detailed aspects of the concept. Thus, it is no exaggeration to say that aptitude can be classified into macro-aptitude (global domains), meso-aptitude (local domains), and micro-aptitude (specific domains). In accordance, the problem with the commonly-used aptitude tests, including PL-GAT, is that they majorly focus on macro-aptitude, ignoring other levels of aptitude.

In conclusion, the development of PL-GAT marks a significant step towards a more comprehensive and personalized approach to aptitude testing. By incorporating non-cognitive elements into the evaluation process, the test provides a more accurate and holistic view of an individual's abilities. As the importance of emotional intelligence, cultural awareness, and sensory experiences in our daily lives continues to grow, it is crucial that aptitude tests evolve to capture the complexity of these elements. PL-GAT represents a promising start in this direction, and it will be exciting to see how this holistic approach transforms the way we evaluate and develop human potential in the future.

Acknowledgments

We would like to express our gratitude to Pishghadam Testing and Language Aptitude

Measurement Center for their support and assistance in conducting this study. Their expertise in developing and validating PL-GAT provided invaluable insights that greatly contributed to the success of this research.

References

- ACT. (2005). *Courses count: Preparing students for postsecondary success*.
- Becker, B. J. (1990). Coaching for the scholastic aptitude test: Further synthesis and appraisal. *Review of Educational Research*, 60(3), 373–417. <https://doi.org/10.3102/00346543060003373>
- Bemis, S. E. (1968). Occupational validity of the General Aptitude Test Battery. *Journal of Applied Psychology*, 52(3), 240–244. <https://doi.org/10.1037/h0025733>
- Bennett, R. E. (2015). The changing nature of educational assessment. *Review of Research in Education*, 39(1), 370–407. <http://doi.org/10.3102/0091732X14554179>
- Bokander, L., & Bylund, E. (2020). Probing the internal validity of the LLAMA language aptitude tests. *Language Learning*, 70(1), 11–47. <https://doi.org/10.1111/lang.12368>
- Briel, J. B., O'Neill, K., & Scheuneman, J. D. (Eds.). (1993). *GRE technical manual*. Educational Testing Service.
- Carroll, J. B., & Sapon, S. M. (1959). *Modern language aptitude test*. Second Language Testing.
- Carroll, J. B. (1973). Implications of aptitude test research and psycholinguistic theory for foreign-language teaching. *International Journal of Psycholinguistics*, 2, 5–14.
- Carroll, J. B. (1981). Twenty-five years of research on foreign language aptitude. In K. C. Diller (Ed.), *Individual differences and universals in language learning aptitude* (pp. 83–118). Newbury House.
- Carroll, J. B., Sapon, S. M., Reed, D. J., & Stansfield, C. W. (2010). *Modern language aptitude test: Manual*. Second Language Testing Foundation.
- Chong, Y. L., & Yeo, K.J. (2016). Cognitive ability and academic achievement of undergraduates. *Man in India*, 96(6), 1777–178.
- Cohen, R. J., & Swerdlik, M. E. (2018). *Psychological testing and assessment: An introduction to tests and measurement* (9th ed.). McGraw-Hill Education.

- Coyle, T. R. (2015). Relations among general intelligence (g), aptitude tests, and GPA: Linear effects dominate. *Intelligence*, 53, 16-22. <http://doi.org/10.1016/j.intell.2015.08.005>
- Damasio, A. R. (2001). Descartes error revisited. *Journal of the History of the Neurosciences*, 10(2), 192-194. <http://doi.org/10.1076/jhin.10.2.192.7250>
- Demetriou, A., Kazi, S., Makris, N., & Spanoudis, G. (2020). Cognitive ability, cognitive self-awareness, and school performance: From childhood to adolescence. *Intelligence*, 79, Article 101432. <https://doi.org/10.1016/j.intell.2020.101432>
- Demetriou, A., Kazi, S., Spanoudis, G., & Makris, N. (2019). Predicting school performance from cognitive ability, self-representation, and personality from primary school to senior high school. *Intelligence*, 76, Article 101381. <https://doi.org/10.1016/j.intell.2019.101381>
- Department of Defense (1984). *Test manual for the Armed Services Vocational Aptitude Battery* (DOD 1304.12AA). Military Entrance Processing Command.
- Dörnyei, Z. (2005). *The psychology of the language learner: Individual differences in second language acquisition*. Lawrence Erlbaum Associates.
- Dörnyei, Z., & Skehan, P. (2003). Individual differences in second language learning. In C. J. Doughty, & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 589-630). Blackwell.
- Farkas, G. (2003). Cognitive skills and non-cognitive traits and behaviors in stratification processes. *Annual Review of Sociology*, 29, 541-562.
- Farrell, J. N., & McDaniel, M. A. (2001). The stability of validity coefficients over time: Ackerman's (1988) model and the General Aptitude Test Battery. *Journal of Applied Psychology*, 86(1), 60-79. <https://doi.org/10.1037/0021-9010.86.1.60>
- Garrett, C. (2022). Aptitude testing as a racially discriminatory and class-skewed method of regulating college admissions. How did it start and who profits from the current scheme? *Tennessee Journal of Race, Gender, & Social Justice*, 12(1), Article 3.
- Grigorenko, E. L., Sternberg R. J., & Ehrman, M. E. (2000). A theory-based approach to the measurement of foreign language learning ability: The CANAL-F theory and test. *Modern Language Journal*, 84(3), 390-405. <http://doi.org/10.1111/0026-7902.00076>
- Humphries, J. E., & Kosse, F. (2017). On the interpretation of non-cognitive skills – What is being measured and why it matters. *Journal of Economic Behavior & Organization*, 136, 174-185. <https://doi.org/10.1016/j.jebo.2017.02.001>
- Johari, S., & Jha, K. N. (2020). How the aptitude of workers affects construction labor productivity. *Journal of Management in Engineering*, 36(5), 04020055. [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000826](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000826)
- Kramsch, C. (2013). Culture in foreign language teaching. *Iranian Journal of Language Teaching Research*, 1(1), 57-78.
- Kuncel, N. R., Crede, M., & Thomas, L. L. (2007). A meta-analysis of the predictive validity of the Graduate Management Admission Test (GMAT) and Undergraduate Grade Point Average (UGPA) for graduate student academic performance. *Academy of Management Learning & Education*, 6(1), 51-68. <https://doi.org/10.5465/AMLE.2007.24401702>
- Kuncel, N. R., Hezlett, S. A., & Ones, D. S. (2001). A comprehensive meta-analysis of the predictive validity of the Graduate Record Examinations: Implications for graduate student selection and performance. *Psychological Bulletin*, 127(1), 162-181. <https://doi.org/10.1037/0033-2909.127.1.162>
- Kyllonen, P. C. (1993). Aptitude testing inspired by information processing: A test of the four-sources model. *The Journal of General Psychology*, 120(3), 375-405. <http://doi.org/10.1080/00221309.1993.9711154>
- Macklem, G. L. (1990). Measuring aptitude. *Practical Assessment, Research, and Evaluation*, 2, Article 5. <https://doi.org/10.7275/a7h9-hh40>
- Mandelman, S.D., Barbot, B., & Grigorenko, E. L. (2016). Predicting academic performance and trajectories from a measure of successful intelligence. *Learning and Individual Differences*, 51,

- 387–393. <http://doi.org/10.1016/j.lindif.2015.02.003>
- Meara, P. M. (2005). *Llama language aptitude tests*. Lognostics.
- Miller, D. M., Linn, R. L., & Gronlund, N. E. (2009). *Measurement and assessment in teaching* (10th ed.). Pearson Education.
- Muhid, A., Yusuf, A., Kusaeri, K., Novitasari, D. C. R., Asyhar, A. H., & Ridho, A. (2020). Determining scholastic aptitude test as predictors of academic achievement on students of Islamic school in Indonesia. *The New Educational Review*, 61(3), 211-221. <https://doi.org/10.15804/tner.20.61.3.16>
- Nugba, R. M., & Quansah, F. (2021). Standardized achievement testing, aptitude testing, and attitude testing: How similar or different are these concepts in educational assessment? *Asian Journal of Education and Social Studies*, 15(3), 42-54. <https://doi.org/10.9734/AJESS/2021/v15i330383>
- Peterson, B. (2004). *Cultural intelligence: A guide to working with people from other cultures*. Intercultural Press.
- Pimsleur, P. (1966). *The Pimsleur language aptitude battery*. Second Language Testing.
- Pishghadam Testing and Language Aptitude Measurement Center. (2020). *Pishghadam language aptitude test*. <http://pishghadam-center.ir/en/adults/>
- Pishghadam Testing and Language Aptitude Measurement Center. (2023). *Pishghadam language-based general aptitude test*. <http://pishghadam-center.ir/en/adults/>
- Pishghadam, R. (2020). *101 mafhoom-e amoozeshi* [101 educational concepts]. Lulu Press.
- Pishghadam, R., & Ebrahimi, S. (2020). Moarefi-e olgoo-e zabamaghz va barrasi-e naghsh-e an dar bargharari-e eretat-e moaser: Gami faratar az tavanesh-e eretabati [Introducing the “brainling” model and examining its role in effective communication: A moving beyond communicative competence]. *Journal of Language and Translation Studies*, 53(3), 1-32. <https://doi.org/10.22067/lts.v53i3.87911>
- Popham, J. W. (1999). Why standardized tests don't measure educational quality. *Educational Leadership*, 56, 8–15.
- Powers, D. E. (2001). Test anxiety and test performance: Comparing paper-based and computer-adaptive versions of the Graduate Record Examinations (GRE) general test. *Journal of Educational Computing Research*, 24(3), 249–273. <https://doi.org/10.2190/680w-66cr-qrp7-cl1f>
- Prithishkumar, I. J., & Michael, S. A. (2014). Understanding your student: Using the VARK model. *Journal of Postgraduate Medicine*, 60(2), 183-186. <https://doi.org/10.4103/0022-3859.132337>
- Qiu, X., & Wu, S. (2011). Global and local regression analysis of factors of American College Test (ACT) score for public high schools in the state of Missouri. *Annals of the Association of American Geographers*, 101(1), 63–83. <http://doi.org/10.1080/00045608.2010.518020>
- Rajalaxmi, R. R., Natesan, P., Krishnamoorthy, N., & Ponni, S. (2019). Regression model for predicting engineering students academic performance. *International Journal of Recent Technology and Engineering*, 7(6S3), 71–75.
- Rauber, M. (2007). *Non-cognitive skills and success in life: The importance of motivation and self-regulation* [Unpublished manuscript]. <https://d-nb.info/1079222375/34>
- Roberts, R. D., Goff, G. N., Anjoul, F., Kyllonen, P. C., Pallier, G., & Stankov, L. (2000). The armed services vocational aptitude battery (ASVAB): Little more than acculturated learning (Gc)!? *Learning and Individual Differences*, 12(1), 81–103. [https://doi.org/10.1016/S1041-6080\(00\)00035-2](https://doi.org/10.1016/S1041-6080(00)00035-2)
- Rosen, J. A., Glennie, E. J., Dalton, B. W., Lennon, J. M., & Bozick, R. N. (2010). *Non-cognitive skills in the classroom: New perspectives on educational research*. RTI Press.
- Runder, L. M. (2009). Implementing the Graduate Management Admission Test Computerized Adaptive Test. In W. J. van der Linden & C. A. W. Glas (Eds.), *Elements of adaptive testing, statistics for social and behavioral sciences* (pp. 151-165). Springer Science. https://doi.org/10.1007/978-0-387-85461-8_8
- Rysiewicz, J. (2008). Measuring foreign language learning aptitude. Polish

- adaptation of the modern language aptitude test by Carroll and Sapon. *Poznań Studies in Contemporary Linguistics*, 44(4), 569-595. <http://doi.org/10.2478/v10010-008-0027-6>
- Salkind, N. J., & Rasmussen, K. (2007). *Encyclopedia of measurement and statistics* (Vol. 1). Sage Publications.
- Sanam Khan, S. (2019). Standardized entrance/ aptitude testing in the era of Foucault's panopticon: The bilingual student and the minority student. *Education and Urban Society*, 52(6), 1–25. <https://doi.org/10.1177/0013124519894978>
- Sasaki, M. (2012). The modern language aptitude test (paper-and-pencil version). *Language Testing*, 29(2), 315-321. <http://doi.org/10.1177/0265532211434015>
- Sireci, S. G., & Talento-Miller, E. (2006). Evaluating the predictive validity of Graduate Management Admission Test scores. *Educational and Psychological Measurement*, 66(2), 305–317. <https://doi.org/10.1177/0013164405282455>
- Skehan, P. (1998). *A cognitive approach to language learning*. Oxford University Press.
- Slack, W. V., & Porter, D. (1980). The scholastic aptitude test: A critical appraisal. *Harvard Educational Review*, 50(2), 154–175. <https://doi.org/10.1177/0013164405282455>
- United States Department of Labor. (1967). *Manual for the General Aptitude Test Battery* [Section 3, Development].
- Venezia, A., & Jaeger, L. (2013). Transitions from high school to college. *The Future of Children*, 23(1), 117–136. <http://doi.org/10.1353/foc.2013.0004>