Invariance in the Factor Structure of Translated Instruments: Multiple Group Confirmatory Factor Analysis and MIMIC Models

Fatma Ayyad

Western Michigan University

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IN VariANCE IN THE FACTOR STRUCTURE OF TRANSLATED INSTRUMENTS: 
MULTIPLE GROUP CONFIRMATORY FACTOR ANALYSIS AND 
MIMIC MODELS

by

Fatma Ayyad

A Dissertation
Submitted to the 
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Advisor: Brooks Applegate, Ph.D.

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When factorial invariance is established across translated forms of an instrument, the meaning of the construct crosses language/cultures. If factorial invariance is not established, score discrepancies may represent true language group differences or faulty translation. This study seeks to disentangle this by determining whether cultural/linguistic variance can be decomposed separately from construct variance intended in the measuring instrument.

Translated forms of the God Mediated Control factor of the Belief in Personal Control Scale (BPCS) (Berrenberg, 1987) was analyzed across multiple samples for measurement and structural invariance among American native English speakers, Arab native Arabic speakers, and Arab bilingual Arabic/English speakers. Moreover, the linguistic proficiency factor of the bidimensional acculturation scale (BAS) (Marin and Gamba, 1996) was included in some models as a possible invariance mediator.

Multiple Groups Confirmatory Factor Analysis (MGCFA) and Multiple Indicator Multiple Causes (MIMIC) Models showed weak factorial invariance between American native English speakers and Arab native Arabic speakers and between the Arab native
Arabic speakers and Arab bilingual speakers when they responded to the Arabic version of the BPCS. Structural invariance was established between Arab native bilingual speakers across the two BPCS forms. Lastly, Arab native speakers and the Arab bilingual speakers responding to the English version showed strong factorial invariance but not structural invariance. This finding was further examined in a MGCFA/MIMIC model to determine if the BAS might mediate the level of structural invariance. The analysis showed that there was no effect for acculturation on structural invariance of Arab bilingual speakers when they completed the English form of the BPCS.

The results of this study indicate evidence of linguistic/cultural differences in translated instruments when administered to mono- and bilingual speakers demonstrating that conventional translation methods fail to create two interchangeable instruments. However, when a bilingual group takes both language versions two weeks apart, results show that structural invariance exists, indicating that these participants are internalizing the construct equivalently crosstranslated forms. Finally, modeling acculturation as a linguistic/cultural mediator did not alter the level of invariance in these groups. Results are discussed in terms of language and culture and the meaning of constructs following translation.
DEDICATION

I dedicate this dissertation to my brother Median Ayyad who has Celebral Palsy. From him I learned to be ambitious and patient. He has taught me with his disability that to get what you really want you must be patient. Thank you brother.
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# TABLE OF CONTENTS

DEDICATION .................................................................................................................... ii

ACKNOWLEDGEMENTS ............................................................................................... iii

LIST OF TABLES ............................................................................................................. ix

LIST OF FIGURES ......................................................................................................... xi

CHAPTER

I. INTRODUCTION .................................................................................................. 1

    Statement of the Problem ................................................................................ 1

    Background ..................................................................................................... 3

        Language and Culture ............................................................................ 3

        Translation .............................................................................................. 6

        Factorial Invariance .............................................................................. 13

        Acculturation ........................................................................................ 15

    Proposed Study ........................................................................................... 16

    Research Questions .................................................................................... 17

    Significance of the Study ........................................................................... 18

        Significance to Evaluation, Measurement, and Research .................... 18

        Significance to Linguistic Discipline ................................................... 18

    Definitions .................................................................................................. 19
CHAPTER

II. REVIEW OF LITERATURE ............................................................................... 26

Social Theories .................................................................................................... 26

Constructivism ..................................................................................................... 27

Language and Culture ....................................................................................... 28

Translation ............................................................................................................. 31

Inquiry Methods .................................................................................................. 31

Marxism .................................................................................................................. 32

Language and Culture ....................................................................................... 33

Translation ............................................................................................................. 36

Inquiry Methods .................................................................................................. 37

Postpositivist ........................................................................................................ 37

Language and Culture ....................................................................................... 38

Translation ............................................................................................................. 40

Inquiry Methods .................................................................................................. 40

Summary of the Three Social Theories ............................................................... 42

Translation ............................................................................................................. 43

Validity .................................................................................................................. 45

Factorial Invariance in Previous Studies .............................................................. 47

Factorial Invariance ............................................................................................. 52
# Table of Contents - Continued

## CHAPTER

- Multiple Group Confirmatory Factor Analysis (MGCFA) .................. 54
- Covariate Multiple Indicators, Multiple Causes (MIMIC) Modeling .. 56
- Ordinal Measures ................................................................. 57
- Procedure for Testing Factorial Invariance ............................ 61
- Acculturation ................................................................. 67

## III. METHODOLOGY ............................................................................................... 70

- Instruments ................................................................. 70
  - The Belief in Personal Control Scale Revised ...................... 71
  - The Bidimensional Acculturation Scale ............................ 71
- Study Groups ................................................................. 72
- Instrument Translation .................................................. 74
- Sample Demographics .................................................. 75
- Procedures and Participant Recruitment .......................... 75
- Data Analysis ................................................................. 78
  - Data Preparation .................................................. 79
  - Model Estimation .................................................. 83
  - Testing Factorial Invariance ........................................ 85

## IV. RESULTS ............................................................................................................. 88

- Multiple Group CFA Results ............................................. 89
  - Descriptive Statistics .................................................. 89
Table of Contents - Continued

CHAPTER

CFA Model Identification ................................................................. 91
Answering the Research Questions .................................................. 92
Summary of the Findings ................................................................. 101

V. DISCUSSION ................................................................................. 104

Conclusion ....................................................................................... 104
Discussion ....................................................................................... 107
Limitations of the Study ................................................................. 111
Recommendations for Future Research ............................................. 112

REFERENCES ..................................................................................... 114

APPENDICES

A. Tables ......................................................................................... 125
B. Figures ....................................................................................... 130
C. SAS Codes .................................................................................. 134
D. Mplus Codes .............................................................................. 140
E. Instruments ................................................................................ 148
F. HSIRB Approval Letter ............................................................... 157
LIST OF TABLES

1. Procedure for Testing Factorial Invariance.......................................................63
2. Symbols.............................................................................................................67
3. Demographic of Sample Responses to the Instruments by Site Recruitment.................................................................73
4. Descriptive Statistics on Missingness in A-NES Before and After Imputation........................................................................................................80
5. Descriptive Statistics of Missingness in A-NAS Before and After Imputation........................................................................................................80
6. Descriptive Statistics of Missingness in Ar-BS (Arabic Version) Before and After Imputation........................................................................................................81
7. Descriptive Statistics of Missingness in Ar-BS (English Version) Before and After Imputation........................................................................................................81
8. T-Test for Difference between Respondents and Non Respondents for Item1 – Item45 Based on Gender........................................................................................................82
10. Descriptive Statistics of the Items in Group A-NAS...........................................90
11. Descriptive Statistics of the Items in Group A-BS_AR.....................................90
12. Descriptive Statistics of the Items in Group A-BS_EN .....................................90
13. Descriptive Statistics of the Language Proficiency Items ................................91
14. Correlation Matrix (with variances on the diagonal) Group A-NES ...............93
15. Correlation Matrix (with variances on the diagonal) Group A-NAS ...............93
16. Test of Measurement Invariance between A-NES & A-NAS .........................95
List of Tables — Continued

17. Correlation Matrix (with variances on the diagonal) Group Ar-BS_EN ........ 96
18. Correlation Matrix (with variances on the diagonal) Group Ar-BS_AR .......... 96
19. Test of Measurement Invariance between Ar-BS_Ar & Ar-BS_EN............... 97
20. Test of Measurement Invariance between A-NAS & Ar-BS_AR............... 99
21. Test of Measurement Invariance between A-NAS & Ar-BS_EN ............... 100
22. The Distribution of the Three Research Question among the Study Groups................................................................. 103
LIST OF FIGURES

1. Multiple Group CFA-MIMIC Model ................................................................. 58
2. Instrument Administration Protocol for Each of the 4 Sample Groups .......... 78
3. Process of Data Collection and Data Analysis .............................................. 86
4. Congeneric Measurement Model for GMD of BPCS, Number in Boxes are
   Actual Item Question Numbers. ................................................................. 92
5. One Factor CFA MIMIC Model for A-NAS and Ar-BS_EN ....................... 101
6. Summarized Results of Factorial Invariance Tests ..................................... 102
CHAPTER I

INTRODUCTION

Statement of the Problem

Language is one of the main factors characterizing a nation’s culture (among other factors such as history, religion, and traditions). Culture is defined as a “pattern of learned, group-related perception—including both verbal and nonverbal language attitudes, values, belief system, disbelief systems and behavior” (Singer, 1987, p. 34). Language is a set of symbols, rules and concepts that reflects meaning in a society. Samovar and Porter (1991) defined language as “the primary vehicle by which a culture transmits its beliefs, values, norms, and world view” (p. 17). Martin & Nakayama (1999) have said that “Language restricts the thoughts of people who use it and the limits of one's language become the limits of one's world” (p. 152). This implies that messages exchanged between the members of a group of people can only describe concepts and ideas that make sense for this specific group of people. Similarly, Spirkin (1983) said that “people speaking different languages perceive things in different ways; language is not only responsible for the content but also for the structure of thought” (para. 25).

1 All references in this dissertation follow APA editorial style as expressed in the American Educational Research Journal.
Regardless of the culture/language involved, when groups of people with different cultural/linguistic backgrounds encounter each other they may not completely communicate because they have different ways of representing, interpreting, and expressing messages and thus perceive the communication in different ways as a function of their cultural/language background. In fact, whenever individuals from different cultures and or language backgrounds come together there is the opportunity for misunderstanding (miss-communication) due to the socio-cultural and linguistic differences of the individuals. Moreover, this basic problem gets magnified whenever the interaction is based solely on written text because of the absence of nonverbal cues within the communication setting. Yet there is a great reliance on purely written communication globally, necessitating the translation of written material from one language to another.

Translation is the process of converting written or spoken communication from one language into another. Perfect translation attempts to convey the meaning of the communication from one language to the other. Following translation of written text, there is the implicit assumption that the text is equivalent across the translated forms. While this assumption may by justifiable in many social contexts, when the written text is intended to measure some underlying psychological construct, e.g., self-esteem, academic achievement, depression, motivation, pain level, or religiosity it becomes necessary to validate the assumed equivalence in the translated forms. For example, if an instrument measuring religiosity is translated from its native source, English, into a new language, Arabic and administered to English-speaking and Arabic-speaking individuals,
one may ask if the English-speaking group has more or less religiosity than the Arabic-speaking group. Unfortunately the validity of this comparison rests on the equivalence assumption noted above and without any empirical assessment of it, any observed difference (or not) may not reflect true differences in religiosity but a failure in translation. Differentiating failures in translation from actual group differences in cross-cultural mono- and bilingual groups is the focus of this dissertation.

Background

Language and Culture

As previously stated, language is a set of symbols, rules and concepts that reflects meaning in a society. Samovar and Porter (1991) define language as “the primary vehicle by which a culture transmits its beliefs, values, norms, and world view” (p. 17). However, all languages have common characteristics. Linguists have established four common components of language: semantics, the emphasis on single words; syntactic, the structure and grammar of the language; pragmatics, the process by which the receiver convert sounds to meaning; and phonetics, which emphasizes the sounds of speech (Martin & Nakayama, 1999). To this, Gorny (1995) added the concept of semiotic language or the application of linguistic methods to objects other than natural language (sign language). Given these common characteristics, language remains the vehicle for values and belief system of a society. Because language has social characteristics, often
social sub-groups tend to develop their own language derived from the mere language. Therefore, in the same society, it is common to find groups of individuals who speak variant or dialect of the same language.

Dialect is defined by Wolfram and Schilling (2006) as “any variety of a language that is shared by a group of speaker” (p. 2). For example on a global scale, American English, British English and Australian English are all dialects of the English language. Moreover there is variety within American English across the United States. Each regional form of American English may also constitute a dialect. To illustrate this I will borrow the following example from Beard (2004).

Most of us would agree that the people in Brooklyn and the people on the Mississippi Delta speak dialects of the English language—well, of the US dialect of the English language. However, if someone who has seldom left Brooklyn were to meet an African American who has seldom left his rural home in the Mississippi Delta, they would hardly be able to communicate with each other. You can imagine the problems between a life-long resident of Yorkshire, England and a Mississippian from the Delta (p.1).

Dialect is the result of geographic proximity. However, dialect may also result from group seclusion. This can be illustrated with the African American dialect commonly known as African American Vernacular English (AAVE). Contrary to other American dialects with major differences in characteristics, African Americans seem to speak AAVE with only some minor regional differences. The development of AAVE is the result of a long history of segregation of African American communities in the USA. However a regional analysis of the African American dialect by Carpenter (2005) shows that time can also be a cause for the development of dialect. As a result of a qualitative analysis on Roanoke Island on the Outer Banks of North Carolina, the author found that
African American English (AAE) shows not only generational changes but also patterns due to regional boundaries (Carpenter, 2005). Consequently, we may identify three non-cumulative elements for the development of a dialect. Delaney (2007) has enumerated individuals’ proximity, group isolation, and historical time. These elements are also fundamental or essential for the development of culture.

Indeed people who live together, people who are isolated under certain circumstances such as political, social, and economic conditions tend to develop common attitudes, values, and communication patterns (e.g. use of jargon at a workplace, or in prison settings). Moreover, anthropologists define culture as shared and learned patterns of belief and perception (Martin & Nakayama, 1999). Though it was previously stated that time, group isolation and proximity are essential for dialect; culture cannot develop without interaction of the isolated individuals. Culture cannot exist without a group of human beings, because attitudes and beliefs must be shared and this cannot be done on an individual level. So, to enable the sharing process human beings have developed, symbols and signs as mean of communication, e.g. language. This has inspired Downs (1971) to say that a group is characterized by their unique aptitude to create symbols of shared experiences which are transferred from generation to generation through language. When a language is transferred from one generation to another, it carries the group’s values, beliefs and perceptions. Therefore a language becomes fundamental for the existence of a culture, as a translator of knowledge, experiences and rules.

It is difficult to dissociate language, dialect and culture. In fact, because of the strong linkage between terms like language and dialect, some groups of people are
known by their language and/or dialect. For example, the case of the Sioux people in Minnesota who are divided into three different linguistic groups. The Dakota dialect is spoken by the Eastern Sioux, the Nakota is spoken by the central Sioux, and the Lakota is spoken by the western Sioux (Hollabaugh, 1996).

Translation

As previously stated, Regardless of the languages involved, when groups with different linguistic backgrounds encounter each other they may not completely communicate because they have different cultural backgrounds. Adewuni (2008) said that language influence people and that people think culturally.

Globalization has created the development and maintenance of new work forms and social groups by breaking down some of the traditional barriers. However globalization does not resolve the problem of language, dialects, and translation when different cultures interact. Moreover the Internet provides new opportunities for cross cultural/language exchanges by breaking down some of the barriers (e.g. distance) that created the different cultures/languages in the first place, it simultaneously creates the potential for communication and language failure.

Communication becomes difficult when people of different languages meet. Even within the same community, country or nation where people use different languages or dialects, the transmission of thoughts (communication) becomes complicated when people speak from different cultures. Communication difficulties due to difference in
cultures are known as communicative understanding (Spirkin, 1983). The author attributed this communication problem to the language which is usually characterized by its own internal logic. Language influences human thoughts. As an example for his argument, Spirkin said that the style of thinking in German philosophical culture differs from that of the French. Thus, without a common language, it is more difficult for people to express and share concerns and ideas. Within a nation with diverse languages, an official language provides a common ground for verbal communication necessary for people to convey their ideas effectively. For example in India, more than 23 different languages are spoken across the country; the multiplicity of languages strains national unity. People would search for a common domestic language in order to avoid the miscommunication. As a solution, Hindi was selected as the official language (S. Thiagarajan, personal communication, November 15, 2007). Within India however, English was another co-official language, (Government of India, 1987). Therefore, according to the government’s Act 19 of 1963, all document or communication from a state to the union should be in both languages: English and Hindi. So government materials needed to be published in both languages. Many governments have chosen to create dual or multilingual documents. Thus, translation is a tool for communication in multilingual Societies.

Fortunately communication with others from different cultures/languages can be possible through human interpreters, document translation and machine translation software. Another solution for individuals engaging in an interlingual communication is to learn the alternative language. However, this last solution is not practical in today’s
global village. The 5th edition of the Ethnologue listed 6,912 languages spoken in the around the globe (Gordon, 2005). Learning even a small number of languages is not realistically possible. Thus there is a need for translation of both verbal and written communication.

Requirements for Translation

Adewuni (2008) said that “theories of translation linked to linguistics and cultures have been proposed to take care of an adequate mediation in translating.” (p.1). Vallejo (2007), writes that the “translator should have a perfect knowledge of the language from which he is translating and an equally excellent knowledge of the language into which he is translating.” (para. 7). Accordingly then, following translation, one expects that a reading of a translated message would lead to the same interpretation one would have from the original message.

Because meaning is extracted from interpretation and interpretation is a function of dialect and culture, any failures in translation of meaning may be a result of failures in the mechanics of language (semantics, syntactic, phonetics, and pragmatics), dialects differences and/or culture. Particular attention is to each of the language components is required depending on the communication medium. For example, semantics and syntactic are more relevant for written communication than pragmatics and phonetics, which are more applicable for oral communication. In Addition, linguists according to the modern methods of translation such as the (sociosemiotic) care about the issue of translation of
fiction. Yongfang (2000), believes in the importance of translation of fiction because “it
deals not only with bilingual, but also bi-cultural and bi-social transference, including the
entire complex of emotions, associations, and ideas, which intricately relate different
countries' languages to their lifestyles and traditions” (para. 7).

Thus the central problem in this dissertation is establishing an empirical method
for estimating and partitioning translation differences into components related to the
translation of the construct meaning of the message which is embedded in a cultural
context and salient dimension of the translation: semantics, syntactic, pragmatics and
phonetics.

Translation Complexity

The complexity of linguistic translation resides in the complexity of culture
because symbols used in language are cultural. Although we cannot identify the number
of global cultures, in a more global context Martin & Nakayama (1999) distinguish two
main cultures: individualist and collectivist. In individualist societies people value
personal autonomy and independence. However in a collectivist society the focus is on
extended families and loyalty to groups” (p. 299). Generally, individualism is a value in
western societies, and it is often perceived in people’s language though the use of
singular pronouns such as “I” and “my” as opposed to collectivist culture with the use of
“we” and “our.” An individual in the first group will say “my house” even though
she/he lives in the house with her/his spouse who is also a co-owner of that house. On the
contrary, individual in a collectivism society would say “*in our house*” to describe the house they co-own with a spouse.

Another example of how culture can affect language is taken from African societies. It is very common in an African French speaking country to call your elder “*le vieux*” or “*la vieille*” (old man, old lady). This has a very respectful connotation because of the value of respect for elders in Africa. Old people are considered wise. Therefore, telling someone that she/he is old means that we think that this individual is wise. However if an African calls a French woman/man *la vieille/le vieux*, this would be impolite within French cultures where being old is a sign of weakness, lack of beauty, etc. (J. Kouamé, personal communication, March 2, 2008).

These subtle cultural differences are also reflected in dialect, thus Vallejo (2007) stated that a “translator should have a perfect knowledge of the language from which he is translating and an equally excellent knowledge of the language into which he is translating,” but she/he should also be “able to behave effectively and appropriately in interacting across cultures” (Martin & Nakayama, 1999, p. 341). This was well illustrated by Neubert and Shreve (1992) who argue that a translator should not just be bilingual, she/he has the duty to say the same thing in two languages. For example, in a text to be translated from an African language to French, the translator would say *wise lady* instead of *old woman*. Furthermore, Abedllah (2002), writes that “translation has linguistics problems that include grammatical differences, lexical ambiguity and structural ambiguity”(para. 10). Lexical ambiguity is an ambiguity found in a single word while the structural ambiguity is found in sentences and clauses (Quiroga-Clare, 2003). An
example of lexical ambiguity is in the word ‘hot’ which can be used to express both temperature and spicy taste. An illustration of structural ambiguity is the following: When someone tells you that ‘Sam read the book on the couch’ he may mean that Sam read the book while seating on the couch or Sam read the book which is presently located on the couch. Therefore, a translation of this sentence alone might create confusion for the reader in the new cultural group if no other consideration is made during translation.

Despite the complications inherent in translation, translation is an unavoidable consequence of global trade and communication. For example, translation presently is needed for economic and social reasons where globalization requires manufacturers, merchants and bankers to invest outside their countries of origin. Products labels must also be translated to state their ingredients, utilities and guide. Oversea employees must be trained to understand not only the new product but also the company’s mission, rules and premises. Therefore translation becomes an essential requirement in the global economy. Moreover translation is necessary for understanding different cultures in conflict and developing support for diversity. For example in a crisis, translation is an essential tool to just solutions between disparate cultures because of enhanced understanding between them.

Consequently the use of translation services has become common for researchers, particularly researchers in social sciences (Hammond, 1990). For example, the researchers in several studies conducted outside English speaking countries, used translated tests and questionnaires originally designed for North American populations (Butcher & Garcia, 1978). In fact there are at least two reasons for encouraging
researchers to use other scholars’ translated research tools. First, it saves time and money. Second, researchers often use research tools that have already been used due to preexisting estimates of validity and reliability in their particular field of study. For example the instrument Self-Perception Profile for Children (SPPC) which was primary created to assess self-esteem among American English speakers was used by Strauss (2000) to conduct a study with Spanish speakers. Another study by Muris, Meesters and Fijen (2003) used the same instrument for a study targeting Dutch school. However, as Lin et al. (2005) remarked “using an adapted or translated instrument does not ensure that the adapted or translated one measures the same constructs as the original one does as a result of the cultural and lingual difference (p. 1). Moreover, Ercikan (1998) said that even a slight translation error in a translated research instrument may affect how its items function. Therefore, for the intelligence test, generally people from other cultures may not be perceived as performing as well as people from the original culture. Although lower scores may indicate that these people are less intelligent.

Thus determining what the translated instrument actually measures, for example does it measure the same constructs in both original and translated forms, is really an examination of construct validity; specifically the validity of test constructs in a cross cultural setting. Since the translation could be responsible for score difference, and not differences in the actual construct within a respondent, it is the responsibility of the test user to demonstrate that the translation of a test has construct invariance with the original test. For instance, a test that is intended to measure a construct (e.g., self-esteem,
motivation, knowledge, etc...) should produce the same score when that test is administered to different groups and/or at different time.

Factorial Invariance

Conducting a study to examine the effect of translation on the stability of the construct and to investigate the issues of both method and item bias is valuable. One of the approaches that can be used to investigate the stability and meaning of constructs is through the study of factorial invariance (Millsap & Meredith, 2007). Studies of factorial invariance usually examine the invariance among subpopulation groups e.g., a population is divided into groups according to demographic characteristics such as race, gender or age among people at the same geographic site who speak the same language and construct invariance is examined among these groups. Such was the case in the gender and race study by Hoelter (Hoelter, 1983) when he examined the impact of gender and race on self-esteem. Since studying factorial invariance has proven useful for measuring the variance among gender and racial groups, it is appropriate to use this same method for studying construct invariance following translation. If an instrument (e.g. test or survey) is translated from its original language to a second language, the researcher must verify that the content and meaning of the constructs in the translated version is the same as in the original version. For example, Lin et al. (2000) write that “using an adapted or translated instrument does not ensure that the adapted or translated one measures the same constructs as the original one does as a result of the cultural and lingual
differences” (p.1). Thus the question arises: can variance of the construct be decompressed into “construct” specific variance and cultural/language variance? Logically following this question one can ask: can translated instruments be used to determine this through a study of factorial invariance?

Through the study of factorial invariance, researchers can ensure that both the content and meaning of the constructs remain intact across translations. However, as previously indicated, language and culture are intertwined and mutually coexist. Thus constructs as measured by a test, exist within a cultural and historical context. Any translation to a new language/culture must attempt to capture the construct in the translated form. Thus a failure in the establishment of factorial invariance may be a result of several factors. For example the construct in fact does not exist in the translated cultural. Alternatively the translation only succeeded in translating the words (syntactic and semantics) but failed on pragmatics. Or there are subtle cultural differences in how the construct manifests itself across culturally.

Lin et al. (2002) discussed translated instruments issues, and suggested confirmatory factor analysis (CFA) as a statistical analysis technique for examining variance and eliminating bias when we study variance among groups. Therefore, this study will define subgroups as individuals from different linguistics backgrounds and investigates the effects of translation on construct invariance. Moreover, this study attempts to determine if construct variance can further be decomposed into unique construct variance and variance due to culture/language. This is by examining subgroups
within two different cultures and now each experienced the two cultures languages as expressed in the construct of acculturation (Rudmin, 2003).

Acculturation

The process of embedding oneself into a new culture, known as acculturation, is ongoing (Redfield, Linton, & Herskovits, 1936). According to the anthropologists Redfield, Linton and Herskovits, “Acculturation comprehends those phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original culture patterns of either or both groups” (Redfield, et al., 1936). Unlike a syncretic relationship were two groups of people become fused, the acculturation is a symbiosis, a situation for mutual sharing during which each of the groups involved give and receive (Herskovits, 1938). Obviously, one’s acculturation into a second (or third) culture is not an assimilation of one side. In reality, some cultural groups make internal adjustment to avoid acculturation or resist to change that can occur during acculturation. For example, some Indians who immigrated to the United States many years ago still wear their traditional clothes, eat the same food, and still practice their original religion. On the other hand, other immigrants, after a long period of time in the new host country cannot be distinguished from the autochthonous, indigenous groups of people who live in that country. Such is the case of the European immigrants who moved to the United States many years ago. “Although social and behavioral scientist agree on the definition of acculturation, there is confusion
about its conceptualization and measurement” (Bornstein & Cote, 2006, p. 7). In the last 30 years, acculturation has become an important theme of discussion among linguists Thriveni (2002) and Karamani (2002) Latest studies Adewuni (2008) have found that language influences our thinking and therefore we think culturally.

Translation is a practice that engages languages; it can easily be affected by culture based on the fact that language and culture are intertwined. Although, the translators are expected to learn the alternative language, their ultimate knowledge of the language must be embedded in the culture that surrounds the language. They must be entrenched with the rules which organize the world of the alternative language because this should constitute the systematical context of their translation. If people think culturally, then being acculturated could improve a translator’s ability to translate a document with fidelity.

Proposed Study

The variance observed in a sample of psycho educational measures, perhaps all measures, is a function of variance in an unobservable construct which is assumed to be responsible for the observed differences in people’s responses plus some degree of measurement error. If the instrument is administered to different people (no matter of the socialized class, gender, ethnic origin, or nationality) we expect that the meaning of any particular score on the instrument is the same across different samples. This is referred to as factorial invariance. The purpose of this study is to examine if translation creates alters
of factorial structure of the instrument. In other words “do the items of a translated questionnaire measure the same construct (same factor structure) and evidence equivalent relationships to theses constructs in all subgroups of the population for whom the measure was used? (Brown, 2006, p. 267). Since linguistics understanding is embedded into a person’s cultural integration, i.e. acculturation, a person’s responses to an instrument may be functionally related to their level of acculturation.

This study proposes to investigate the factorial invariance of translated instruments within and between primary language culture and translated language culture. Furthermore, this study seeks to determine if the respondent’s level of acculturation mediates the observed factorial stability of the underlying constructs the instrument is intended to measure.

Research Questions

From the above discussion, the following three questions emerged and were considered to be the focus of the research:

1. What level does measurement invariance exist between an original and translated instrument among mono- and bilingual samples?

2. If measurement invariance exists, does invariance extend to structural invariance among the mono- and bilingual samples?

3. If measurement or structural invariance does not exist, does the respondent’s level of acculturation mediate the level of invariance?
Significance of the Study

Significance to Evaluation, Measurement, and Research

This study has the potential to impact the disciplines of measurement and research because it specifically combines multiple group confirmatory factor analysis (MGCFA) and multiple indicators, together with multiple causes (MIMIC) factor analysis. By utilizing both of these techniques simultaneously in one analysis it is expected to break apart variance due to translation effects (MIMIC part of the analysis) from the meaning and stability of the underlying construct (MGCFA part of the analysis) across different samples that vary along a language/ cultural continuum. The two models MGCFA and MIMIC will be explained in the section of factorial invariance in the following chapter.

Significance to Linguistic Discipline

This study aims to establish an understanding of using translated measures across different cultural groups. Doing so, linguists can benefit by making the appropriate consideration while translating cross-cultural documents. This study emphasizes the adequacy of using back translation method in cross cultural studies.
Definitions

Acculturation: “When peoples of different cultures interact and intermix, they have some probability of adopting each other’s products, technologies, behaviors, languages, beliefs, values and social institutions” (Rudmin, 2003, p. 2). Unlike a syncretic relationship were two groups of people become fused, the acculturation is a symbiosis, a situation for mutual sharing during which each of the groups involved give and receive (Herskovits, 1938).


Confirmatory Factor Analysis: “Is as type of structural equation modeling that deals specifically with measurement models, that is, the relationships between observed measures or indicators and latent variables or factors” (Brown, 2006, p. 1).

Concurrent validity: “is studied when one test is proposed as a substitute for another (for example, when a multiple-choice form of spelling test is substituted for taking dictation), or a test is shown to correlate with some contemporary criterion (e.g., psychiatric diagnosis)” (Cronbach & Meehl, 1955, p. 2).
Content Validity: “is established by showing that the test items are a sample of a universe in which the investigator is interested. Content validity is ordinarily to be established deductively, by defining a universe of items and sampling systematically within this universe to establish the test.” (Cronbach & Meehl, 1955, p. 2).

Construct Validity: “the extent, to which a test measures the attribute, thought of a theoretical concept, that it is designed or used to measure. In one specific treatment it is given by the squared correlation between the test score and the common factor of the items” (McDonald, 1999, p. 457)


Culture: “The deposit of knowledge, Experience, beliefs, Values, Attitudes, meanings, social hierarchies, religion, notions of time, roles, spatial relationships, concepts of the universe, and material objects and possessions a acquired by a group of people in the course of generations through individual and group starving” (Samovar & Porter, 1999, p. 7). Culture is the “sum total of ways of living including behavioral norms, linguistic expression, styles of communication, patterns of thinking, and beliefs and values of a group large enough to be self-sustaining transmitted over the course of generations”(Jandt, 2001, p. 499).
Decomposed: To break down or resolve into component elements (Simpson & Weiner, 1993, p. 610)

Dialect: Dialect is any variety of a language that is shared by a group of speakers (Wolfram & Schilling, 2006). Dialect is “a variety of speech differing from the standard” (Jandt, 2001, p. 499)

Dialectics: Critical investigation of truth through discussion and reasoning; discovery of truth through consideration of opposite theory (Guba & Lincoln, 1994).

Factor analysis: defined as a statistical method that determines the relationship between set of observed variables and constructs. These constructs are known as underlying latent factors (K. Joreskog & Sorbom, 1971), (Muthen, 2005)

Factorial Invariance: Factorial Invariance for a measure means that measurement model is the same when the measure is used in different subgroups and across different occasions (Ward, Velicer, Rossi, Fava, & Prochaska, 2004).

Globalization: The compression of the world and the intensification of consciousness of the world as a whole (Robertson, 1992, p. 8)
happenings are shaped by events occurring many miles away and vice versa (Giddens, 1990, p. 64).

Hermeneutics: Modern usage refers to the study of the methodological principles of interpretation more generally (Guba & Lincoln, 1994).

Invariance: Invariance in term of factor analysis assumes the same numbers of common factors are present. Then it turns to the factor loadings which are the latent variable regression coefficients used to define the relationships with the observed variables. There are different types of Invariance:

Language: Language is the primary vehicle by which a culture transmits its beliefs, values, norms, and world view (Savamor & Porter, 1991, p. 17). Language is the highest form of thought expression, the basic means of controlling behavior, of knowing reality and knowing oneself and the existence of culture (Spirkin, 1983).

Measurements: The Systematic assignment of numbers on variables to represent characteristics of persons, objects, or events (Vandenberg & Lance, 2000).

Mplus: A statistical modeling program that provides researchers with a flexible tool to analyze their data. Mplus allows all analysis of both cross-sectional and longitudinal data
single-level and multiple-level. Nominal or ordinal data could be analyzed by Mplus (Muthén & Muthén, 2009, p. 1).

Nation: A society integrated in material and moral terms, with a stable and permanent central power, fixed frontiers, and a relatively stable moral, mental and cultural unity among the inhabitants who consciously respect the state and abide by its laws.

Non invariant: the lack of equality of the size of the pattern (Millsap & Meredith, 2007).

Partial Invariance: “A situation in which there is no perfect invariance for specific parameters, but neither is there evidence of their complete inequality.” (Dimitrov, 2010, p. 128)

People: Group of human beings “can be small and large and in many colors, wear different clothes, have different ideas of beauty, many of them believe in God, other believe in many, and other believe in non, some are rich and many are poor, people from various cultures differ from one another…” (Jandt, 2001, p. 70)

Semiotic: "Semiotic is an application of linguistic methods to objects other than natural language." It means that semiotics is a way of viewing anything as constructed and functioning similarly to language. This "similarly" is the essence of the method. Everything can be described as language (or as having a language): the system of
kinship, card games, gestures and facial expressions, the culinary art, religious rituals and behavior of insects (Gorny, 1995).

Strict Factorial Invariance: When the parameters have equal factor loadings, equal intercepts and equal variances and covariances (Dimitrov, 2010).

Strong Factorial invariance: When the parameters have equal factor loadings and equal intercepts (Dimitrov, 2010).

Translation: A rewriting of an original text. All rewritings, whatever their intention, reflect a certain ideology and a poetics and such manipulate literature to function in a given society in a given way (Lefevere, 1992).

Unique Variance: The relationships among the measurement errors of the indicators (Brown, 2006). Unique variance: That variance of a variable which is not explained by common factors. Unique variance is composed of specific and error variance “variance of the unique part of a variable” (McDonald, 1999, p. 468).

Validity: “Validity of test is the extent to which the test measures the attribute it used to measure” (McDonald, 1999, p. 468).
Variance: A measure of the dispersion of a set of data points around their mean value. Variance is a mathematical expectation of the average squared deviations from the mean (Crocker & Algina, 1986). Variance: Factor analysis assumes that variable’s variance is composed of three components: common, specific and error (Pohlmann, 2007).

Weak Factorial Invariance: When the parameters have equal factor loadings (Dimitrov, 2010).
CHAPTER II

REVIEW OF LITERATURE

The review of literature considers four main concepts on this dissertation: (1) social theory (2) translation (3) factorial invariance (4) and acculturation. In this chapter, each concept is defined and discussed both according to the recent research, literature and social theories. This chapter also presents a review of previous studies that are relevant to the above and begins by outlining the philosophical explanation or social theory that informs this study.

Social Theories

A review of the literature reveals several definitions of the concept of social theory. According to Guba and Lincoln (1994) social theory or paradigm is a “set of basic beliefs that define the nature of the world, the individual’s place in it and the range of possible relationships to that world and its parts” (p. 107). Williams (1998) “paradigm provides a conceptual framework for seeing and making sense of the social world” (para. 4). For the purpose of this study, social theory or paradigm will be viewed as “a prerequisite to perception itself. What man sees depends both upon what he looks at and also upon what his previous visual-conceptual experience has taught him to see” (Kuhn, 1996, p. 113). Though conceptually all these definitions do not differ considerably from each other, Kuhn’s definition will be considered as it takes in consideration all; time,
place and personal experience. This definition is appropriate because it is expected that the decisions that the translator makes regarding word choice are directed by certain practices and believes. Similarly, the respondent of the survey will be answering these questions based on personal experience. However, because social theory is not the factor to be investigated in this study, the process of the translation does not consider any social theory directly. During the translation, the original text was not metaphrased (translation word-to-word) and the translation was implemented with respect to the language structure (grammar) of the targeted language.

The following section describes the theoretical framework that underlies this study. The theoretical framework applies social theory to explain the structures of this study within a particular school of thought. Although there are several social theories only postpositivism, constructivism and Marxism will be discussed because of their potential relationship with this research. Only the framework from one of these theories guides this dissertation.

Constructivism

Hatch (2002) writes that “constructivists assume a world in which universal, absolute realities are unknowable, and the objects of inquiry are individual perspectives or constructions of reality” (p. 15). Constructivism is also defined as “a philosophical school of thought arguing that research is fundamentally theory-dependent. According to constructivists, the theoretical position held by researchers not only guides their basic position, but also determines what gets constructed as a research problem, what
theoretical procedures are used, and what constitutes observations and evidence” (Boyd, 1991, p. 202). Constructivist epistemology asserts that “Knowledge is symbolically constructed and not objective; that understandings of the world are based on conventions, that the truth is, in fact, what we agree it is” (Hatch, 1985, p. 161). Because those who adhere to this perspective believe in subjectivism, constructivist researchers prefer the use of qualitative methodology in their practice, whereas other researchers may use statistical methods (Hatch, 2002).

Language and Culture

Culture and its components are viewed differently by every social theory. For social constructivists, the emphasis when explaining culture and its context are in the search for what happens between groups in a given society who produce knowledge based on their understanding (McMahon, 1997); (Derry, 1999). Constructivist, propose that individual’s confictions are affected by their society and culture by interpreting the meaning of things they bump into. In fact, the meaning we get from objects and events comes from our interaction with the community we live in (Kim, 2001). For example, the way bonds among individuals in a marriage are perceived depends on societies and people’s cultural background. In some societies, marriage may be referred to as the union of two families through the bond of a child from each of these families. In other societies such as those found in the western societies, though the two families support their children, a marriage is purely the union of two individuals. Another example is the connotation that objects hold for people. For someone with an Islamic background, an
olive tree is automatically associated with the Holy Quran, the foundation of the religion. The same olive tree may be perceived as just another kind of tree for an individual from a different cultural background.

In reference to language, constructivists argue that it shapes our thoughts (Best, 2008; Boroditsky, 2009). For example, Mr. Adam may ask his wife who visited them the night he was not in town. Let’s suppose that the wife answers: Smith. This answer may be confusing as the wife can be referring to Mr. Smith or Ms. Smith. However in Arabic, as soon as the verb “to visit” is formulated, the husband will know if his wife was talking about Mr. Smith or Ms. Smith. In Arabic, the verb is modified to mark the subject’s gender.

In addition to the oral requirements, other rules which govern the instruction of a message can considerably shape an individual’s thought. For example in Arabic and Hebrew, writing proceed from right to left as opposed to from left to right in French, English, Spanish etc. In an empirical example provided by Boroditsky (2009), she shows how the direction (writing from left to right or the opposite) can shape the user’s mind. She gave her research subjects a set of pictures that showed some kind of temporal progression (e.g., pictures of a man aging). The research subject is task was to arrange the shuffled photos on the ground to show the correct temporal order. She tested each person in two separate sittings, each time facing different cardinal direction. She found that when she asked English speakers to do this, they arranged the cards so that time proceeds from left to right. However, Hebrew speakers laid out the cards from right to left. If the work by the Hebrew was given to the English person to interpret, he would say that the person in the picture is getting younger.
Constructivists believe that language shapes the way people think and difference in languages enables people to construct meanings, from events and their language experiences, based on that they see the world and communicate with others (Boroditsky, 2009).

Usually, misunderstanding and miscommunication between individuals from different cultures are due to improper interpretation of cultural artifacts, attitudes, behaviors or language as oral or visual representations of thought. Thus, problems in communication can still exist among people from different cultures even though each masters the syntactic and phonetic aspect of the other language. Morgan (2009) agrees with this version when she wrote:

Problems that may result from cultural differences in business are compounded by the fact that even though a native speaker of one language has learned the other person’s language, he or she may not have been sufficiently exposed to actual usage of the target language. Mistakes in usage can occur even when grammar and pronunciation are correct (para. 1).

It is not too exaggerated to say that to communicate with someone of different language one must know the language of that person. However for constructivists, the knowledge of others’ language is necessary but not sufficient for communication/construction. Constructivists believe that “cultural communication can be constructed in ongoing interaction” (Piller, 2004). For instance two individuals from difference cultural background and different language can always communicate without a predetermined common language. Communication in such situations can occur by constructing meanings for things or thoughts through the interpretation of non-verbal stimuli (body language, symbols, postures, etc.) generated between two persons or more (Khan, 2001).
Translation

The constructivist Kiraly (2001) defined translation according to the modern theories of linguistics as “a process of transferring meaning from one text to another” (p.50). However, all human beings are social and cannot make that transfer of meaning without discrepancy. Therefore, according to Kiraly (2001), other constructivists such as Diewi and Piaget believe that human beings construct meaning of text in relationship with their personal experience and language. Any individual who is bilingual will understand and agree, while reading a text; a person brain is constantly reacting with the content and context to create a meaning for the imbedded idea based on personal knowledge and experiences. Rorty (1971) named this “process conversation of mankind” (p.264). There is no doubt that constructivist believe translation is needed for communication purpose, especially when people from different linguistic background interact. Therefore, constructivists suggest that translators consider language components and culture during their translation tasks.

Inquiry Methods

The construction of situational meaning provides a justification for this study. In other words, the validity of translated surveys may be affected by the cross cultural setting. For this particular research, a constructivist would attempt to look for reasons explained why the answer on a particular version of the survey is different from the same question in a translated version; or why individuals responded the way they did.
Constructivists believe that a study analyzing a survey instrument is incomplete unless it investigates why the participants answer the same items differently, where the potential difference lies at the core of the meaning “construct.” For a constructivist researcher understanding this core is a fundamental component of any research project. However, there is no way for the researcher to know that core. Responding in certain manner may be caused by the survey, the local environment, or the world context or all of these (L. Fredman, personal communication, 2009). Research participants are not “empty vessels”, Freedman added. Each respondent will construct a response base on her/his background and knowledge and how they interpret the scale, i.e. Often True, True, False, Always False. Based on the questions which organize this study, a constructivism approach will not be adopted because we do not attempt to explain why answers are different across groups, nor is this study intends to analyze the survey individually. Instead this study intends to explain how different culture groups respond to a translated instrument and if that changes the meaning of the underlying construct intended in the instrument.

Marxism

Marxism is a social theory based on the economic and political theories of Karl Marx (1818-1883) and Friedrich Engels (1820-1895). Marxism, also known as “Scientific Socialism” embraces political, economic and social theory (Sewell & Woods, 2000). Marx and Engels worked in various fields of learning, focusing on the needs and
interests of the workers in society. From this work they developed their explanations based on economic history. According to Swell and Woods (2000)

The Marxist theory provides a richer, fuller, more comprehensive view of society and life in general, and clears away the veil of mysticism in understanding human and social development. Marxist philosophy explains that the driving force of history is neither "Great Men" nor the super-natural, but stems from the development of the productive forces (industry, science, technique, etc.) themselves. It is economics, in the last analysis, that determines the conditions of life, the habits and consciousness of human being (para, 3).

Although Marxist theory is rich in its perception of such topics in social history, this study is not intended to catalog those topics. However the central concern will be to inspect the Marx’s view of language, culture and translation.

Language and Culture

Some linguists claimed that Marx opinions of language are fragmented and that Marx has a little focus on language (Newmeyer, 1986, p. 105). However, understanding Marx discussion about language requires deriving his thoughts about language from his economic and philosophical writings. According to Volosinov (1973) “the very foundations of a Marxist theory of ideologies – the bases for the studies of scientific knowledge, literature, religion, ethics and so forth – are closely bound up with the problems of the philosophy of language” (V.N.Volosinov, 1973, p. 9).

According to Marx, language is a human characteristic that represents the process of thoughts. This is known as the “Practical Consciousness” (Spirkin, 1983). Marx also argued that language and consciousness cannot be separated because they both share a
social dimension which is rooted in the collective nature of human activity (Marx & Engels, 1970, p. 51). This overlap of language and consciousness forms the human relationship with nature. In the same way, discussing the view of language and consciousness among Marxists such as Holborow (2006) said that the relationship between language and consciousness is established because they are both connected to the material world around them. Thus, for Marx the human relationship with nature is a human labor. He defined labor as “a process between man and nature, a process by which man, through his own actions, mediates, regulates and controls the metabolism between himself and nature” (Marx, 1976; cited in Holborow, 2006, p. 5). Simply, Holborow (2006) commented on Marx definition of labor considering that labor “sets humans a part of animals” (p.5). To simplify, language could be defined as a vehicle that connects the individual with his society. In other words language, consciousness, and labor represent the foundation of human communication and individuals’ interaction (Spirkin, 1983).

As language is a human process it is important here to view the role of language in relation to work. Marxists believe that language is “the vital element” in the production of ideas (Marx, 1975 cited in Holborow, 2006). That means language is fundamental to express one’s thoughts, to control human behavior. Above all language is essential for understanding reality, critical for self-awareness and the awareness of culture. Marxist’ thought about language is that people are divided into classes in conflict over land and wealth and their existence is based on both human work and the language they use. For example, people express their opinions, share feelings, and communicate through the language. Therefore, language serves every individual in the society but not the same way for every individual. Furthermore, the Marxist Stalin (1950) said that:
language has been created precisely in order to serve society as a whole, as a means of intercourse between people, in order to be common to the members of society and constitute the single language of society, serving members of society equally, irrespective of their class status (p. 3).

Marxists believe that language ignores all social barriers because it serves all components of the society. Previously we have defined culture as all societal components including political legal, religious, artistic, philosophical views and language. However for the Marxists, language is something else and the other elements are the components of what is called superstructure (Stalin, 1950). Unlike the superstructure that is created to serve a given base, economical system (capitalism or socialism), language is meant to serve all members of the society and will continue to serve even when the base changes. For example, when the feudal and capitalist systems were substituted by the socialist system in Russia, Pushkin’s language remained and the existing modern Russian language does not vary from the Pushkin’s language (Stalin, 1950). However the Marxists believe that the development of technology requires language to accept new words (Stalin, 1950). Assuming that superstructure is the equivalent of culture because it has all of its components, then for Marxists language is different from culture (Stalin, 1950). According to Marxists, the aristocracy or bourgeoisie invented a language, the bourgeois language, to communicate among themselves, produce knowledge, and reproduce private society requires distinguish themselves from the general population. Marxists believe that the bourgeois language is not really language for two reasons. First, they argue that the bourgeois dialect and jargon are derived from the national language. Second because the language is limited to only a class of people and does not serve the entire society. Therefore, Stalin (1950) wrote that Lenin had classified capitalism as
consisting of two cultures: the bourgeois and the rest of the society, one might argue that Lenin is referring to two classes of individuals with two cultures. However, for Lenin, there is only one language the national language. Though he does not ignore the existence of the two social classes, Lenin does not think that the existence of these social classes implies two languages. Lenin believes that language and culture are two different things (Stalin, 1950).

Translation

As mentioned earlier previously, communication is the practices that help people to interact and understand each other (Martin & Nakayama, 1999). The Marxists believe that communication is important for human existence and it helps people to build their social experience and develop their thoughts (Spirkin, 1983). Marxists also believe that language is the communication vehicle to human kind. Although, Marxists deem that language is a means of communication, they also could not deny communication problems due to language. Misunderstanding is one of the major issues encountered during communication. While Davaninezhad (2009) believes that translation helps resolve this issue. Spirkin (1983) doubts that translation actually helps people to understand each other. Spirkin states that “the translation of the ancient Indian writings into Russian, cannot help understand the ancients Indian” (p. 4). He believes that to understand them one must enter into the life, the culture of the people that created it and the historical epoch in which it was written (Spirkin, 1983, p. 4).
Inquiry Methods

A review of the Marxists’ understanding of language, culture and translation indicates much the same concerns that have motivated this study. These concerns are well presented in Spirkin’s (1983) statement:

Thought is always mental activity in any language. If a given thought is expressed in English, Russian or French, despite the differences in linguistic form, the content of all three sentences remains the same. The structure of a language is formed under the decisive influence of objective reality, through certain unified standards of thought, through the category structure of consciousness. But at the same time these unified universal standards of thought are materialized in thousands of different linguistic ways. Every national language possesses its own structural and semantic specifics (p.7).

There is no doubt that Marxism could support a research project like the one proposed here. However, giving the Marxism philosophical thought, it is expected that, a Marxist will be interested in studying the responses considering the participants’ social class, gender, ethnicity, religions etc. This interest is consistent with multiple group confirmatory factor analysis. Therefore, a Marxist researcher may still use the methodology used in this current study. However, a Marxist might also follow another methodology such as qualitative method to investigate potential differences between the translated versions of an instrument.

Postpositivist

Phillips & Burbules define Post-positivism as a “nonfoundational approach to human knowledge that rejects the view that knowledge is erected on absolutely secure
foundations—there are not such things; Post-positivists accept fallibilism (the philosophical doctrine that absolute knowledge is impossible) as an unavoidable fact of life” (Phillips & Burbules, 2000, p. 29). Postpositivism is “characterized by a more nuanced belief in an ontologically realist “out there” reality that can only be known within some level of probability” (Groat & Wang, 2001, p. 32). According to postpositivists, “Knowledge is conjectural. They believe there are real warrants, for asserting these beliefs or conjectures — although these warrants can be modified or withdrawn in the light of further investigation” (Phillips & Burbules, 2000, p. 26). Postpositivist epistemology considers the inquiry as a method in prediction and explanation of phenomena. In their method they assume that the reality (truth) may be approximately reached but not fully captured (Guba & Lincoln, 1994). Because post-positivists are objective in their search for the truth, they are interested in empirical research, though they consider qualitative methods. In contrast, other thinkers such as the constructivists, objective or the so called truth “is not fundamental or inherent in science but is a linguistic achievement that is built upon the complexity of human functioning” (Ellingson & Ellis, 2008).

Language and Culture

Similar to constructivists and Marxists, postpositivist believe that culture and language guide people’s thought. For instance “An apple will fall in every culture; this is an objective fact. Our understanding of the essence of gravity and the way we use that understanding is not separate from our culture, our values, our social status” (Dancy &
Henderson, n.d) (p. 3). In a society where people believe in God, an apple that falls on the head of a farmer could be a gift from God. However, for postpositivists, there is a unique reason for the apple to fall. The apple might have fallen despite the farmer’s presence. To investigate the reason that lead the apple to fall, postpositivists will conduct a “constant comparison” studies (Glaser & Strauss, 1967, p. 36) and “analytic induction” (Robinson, 1951, p. 812).

The Sapir-Whorf hypothesis in linguistics explains the postpositivist empirical thought regarding the effect of language and culture on the way human think. The Sapir-Whorf hypothesis states that thoughts and behavior are determined or partially influenced by language (Kay & Kempton, 1984). The linguistics Sapir and Whorf advocate that language shapes people perception of reality and how they see the surrounding world (O’Neil, 2006). O’Neil also mentioned that other linguists such as Boroditsky (2009) conducted cross cultural comparisons to test the Sapir and Whorf hypothesis. Boroditsky’s (2009) studies revealed that the name that Russian speakers give to different shades of the color blue provide them with different perception of the color blue compared to English speakers. Russians did not see different types of blue but instead they listed different type of colors goluboy and siniy respectively translated dark blue and light blue by English speakers (Boroditsky, 2009). In sum, postpositivist believe that language and culture guide the way people think. As consequence, different cultures interpret things in different way.
Based on postpositivist views, translation was defined as the process that involve transposition of thoughts expressed in one language by one social group into the appropriate expression of another group (Karamanian, 2002). A postpositivist translator may think that it is the translator task to consider culture, language, and thoughts in their translation. This is because different languages cannot express the same meaning, which makes the speakers to think differently (Thriveni, 2002). Therefore, the translators are to seek for the appropriate method to translate concepts into another language. As it was mentioned in previous paragraph, language and culture are intertwined. This means that language reflects cultural values that are well known for the speakers of this language only. In this study, numerous examples were provided to illustrate the link between language and culture. For instance, the fall of an apple may remind some people the force of gravity while for others this can be just a gift from God. Therefore, for postpositivist translators must consider people’s thought and culture when translating.

Inquiry Methods

Both the researcher’s philosophical tendency and the study’s methodology dictate the postpositivism approach for this study. First, the epistemology that drives this research was derived from the social theory which reflects my personal thoughts and believes. The fact that I am questioning the validity of translated instruments from one language to another suggests that I am searching for the truth, the reality, the
effectiveness of using translated instruments in research. In the way to capture that reality or simply to be close to it, this study is (1) using a comparison standard (methodology), (2) aims to determine how the factor structure of translated instruments will be when different cultural group answers the instrument and (3) utilize an extensive quantitative methodology (Factorial invariance) for examination of this. Therefore the postpositivist epistemology seems to be in alignment with the thoughts and beliefs underling this study. As a researcher with a post-positivism tendency, I led this study using empirical research conducted in cross cultural setting.

Second, the research methodology follows an inductive logic which aligns with the postpositivist approach. Trochim (2006) distinguished between two types of logics that guide our logic of thinking: inductive and deductive. Deductive thinking starts from more general thought to a more specific. In research, deductive logic leads to the test of hypothesis with data while inductive logic tends to lead to an exploratory closes with the formulation of general conclusion or theories. The postpositivist’s method of research seems to be inductive because a pastpositivist’s arguments start from observation, to pattern, then to hypothesis and finishes with a theory. In the contrast, the Marxism and the constructivist approaches use the opposite chain of events. For example, a Marxist or a constructivist will be thinking about a theory about the topic and then go down to hypothesis to be tested “top-down” (Trochim, 2006, para. 2). As an empirical study, we assume in this research the logic of observation, pattern, hypothesis and theory. Therefore, the postpositivist approach fits this investigation.
Summary of the Three Social Theories

According Guba & Lincoln (1994) the following summarizes the basic beliefs of the three social theories in terms of this research; ontology, epistemology, methodology. In term of ontology, the postpositivism is looking for the scientific reality. This study analyzed how the “reality” of the construct of translated instruments will look. If we use the instruments in cross cultural settings (different language groups), does a difference exist, and can the variance decompose into language/cultural effect? The purpose of epistemology in postpositivism is to be objective in finding the truth. The methodology for postpositivism is experimental (factorial invariance method), and the verification of hypotheses is mostly quantitative. The Marxism ontology is also looking for the “realities”. Perhaps it looks for the variance among the groups considering that the virtual reality is shaped by society, politics, culture, race, gender, economics, etc. However, the epistemology of Marxism is subjectivist in value-mediated findings. The Marxists methodology is dialectical, e.g., multiple groups confirmatory factor analysis is analytical and naturalistic. However, the constructivism ontology is looking for more than one “reality.” Constructivism is, perhaps, looking for the variance among the groups considering that the reality is constructed based on peoples’ differences. The constructivist is subjectively constructed. Its methodology is hermeneutical, dialectical and naturalistic.
Translation

Psychologist, educators, and researchers debate the possibility of perfect translation, and question the stability of the constructs when research instruments are translated into other languages. Neubert and Shreve (1992) presented translation as a paradox because though we always use it, it does not always seem possible due to distortion and loss caused by cultural and language characteristics. The same idea was also supported by Lawrence (Lawrence, 1998) when she said that any translated document can be improved because she does not believe in a perfect translation (p. 229). Therefore, according to Lawrence (1998) and Neubert and Shreve (1992), any attempt to translate a document results in a translated document that is close to the original but not equal to it. The discrepancy between original and translated versions of documents will affect both the stability (reliability) and meaning (validity) of the constructs in the translated version, possibly resulting in biased estimate regarding what the instrument is being used for. Van de Vijver & Hambleton (n.d.) defined three types of bias: construct bias, method bias and item bias. Construct bias is characterized by divergence of cultures. An example comes from Lin et al. (2005) “filial piety, which means how obedient people are to their parents, differs greatly between Western cultures and Eastern cultures” (p. 2). Method bias is defined by Van De Vijver (1998) and Meiring, Van de Vijver, & Rothmann (2006) as bias caused by all sources of variance resulting from the methodological procedures, such as sampling, administration, form, and instrumentation. Instrument bias, instrument readings vary over time or across tested groups (Schuster & Powers, 2005). Item bias is related to the instrument variance but at the item level.
Hambelton and Rodgers (1995) give an example from Scheuneman (1982) which focused on language bias against African Americans. Scheuneman found in an item in which: Students were asked to identify an object that began with the same sound as "hand." While the correct answer was "heart," black students more often chose "car" because, in black slang, a car is referred to as a "hog." The black students had mastered the concept but were selecting the wrong item because of language differences (Different Kinds of Bias) (para. 2).

Conducting a study to examine the effect of translation on the stability of the construct and specifically to investigate how both method and item bias affect score interpretability is relevant and needed. One of the approaches that can be used to investigate the stability and meaning of constructs is through the study of factorial invariance (Cudeck & Robert, 2007). Factorial invariance is the examination of the score invariance among subpopulation groups. In a factorial study, a population is divided into groups according to demographic characteristics such as race, gender or age and test score are examined for consistency in meaning and magnitude. Such was the case in the gender and race a study by Holter (Hoelter, 1983) when he examined the differences in gender and race on self-esteem. Studying factorial invariance has been proved useful for explaining and understanding variance among gender and racial groups. So it is natural to apply this method for studying construct invariance following translation. If an instrument (e.g. test or survey) is translated from its original language to a second language, the researcher must be concerned about the content and meaning of the constructs in the translated version. For example, Lin et al. (2005) writes that “using an adapted or translated instrument does not ensure that the adapted or translated one
measures the same constructs as the original one does as a result of the cultural and lingual differences” (p. 1). By studying factorial invariance, researchers can ensure that both the content and meaning of the constructs remain intact across translations. However, as previously indicated, language and culture are intertwined and mutually coexist. Thus constructs as measured by a test, exist within a cultural context. Any translation to a new language/culture must attempt to capture the construct in the translated form. Thus a failure in the establishment of factorial invariance may be a result of several things. For example the construct in fact does not exist in the translated cultural. Alternatively the translation only succeeded in translating the words (syntactic and semantics) but failed on pragmatics. Or there are subtle cultural differences in how the construct manifests itself.

Lin et al. (2005) discussed translated instruments issues, and recommended Confirmatory Factor Analysis (CFA) as a statistical analysis technique for examining variance and eliminating bias. Therefore, this study defined subgroups as individuals from different linguistics backgrounds and investigated the effects of translation on construct invariance. Moreover, the study attempted to determine if construct variance can further be decomposed into unique construct variance and variance due to culture/language by examining subgroups within two different cultures.

Validity

Before using a test it is important to know how well the test measures an attribute. This concern was addressed by Cronbach & Meehl (1955) when they recommended the
validation of the psychological tests. The measurement concept validation is “…the process by which a test developer or test user collects evidence to support the types of interferences that are to be drawn from test scores” (Crocker & Algina, 1986, p. 217). According to McDonald (1999), a test is valid when the test score evidences the extent to which it measures the attribute of the examinee. Simply a test is valid when it measure what it purports to measure. Cronbach & Meehl (1955) defined three aspects of validity: content, criterion, and construct validity. They said that a test has a content validity if the items of the test represent all the items from which they are drawn. A test is said to have criterion validity if it represents one of the two types of the criterion validity: “Predictive validity” or “Concurrent validity” (Crocker & Algina, 1986, p. 224). Predictive validity occurs when the criterion measures are achieved at a time after the test. Aptitude tests are examples of predictive validity because they determine who of the test takers are likely to succeed or to fail certain subjects. The concurrent validity is achieved when a test score measures the actual criterion at the time the test is taken. For example an individual’s score on a depression test must represent that individual’s depression level at the time the test is administered. Construct validity is defined by McDonald (1999) as “the degree to which individual process some hypothetical trait or quality construct presumed to be reflected in the test performance.” (p. 199). Cronbach & Meehl (1955) suggested that construct validation should be investigated “whenever no criterion or universe of content is accepted as entirely adequate to define the quality to be measured” (p. 2). To establish construct validity a measurement model is needed. Although there are several variants of CFA related to construct validity, researchers such as Brown (2006), Millsap & Meredith (2007) and Muthen & Muthen (2009) advocate the Confirmatory Factor Analysis (CFA)
as an effective Structural Equating Modeling (SEM) method to establish construct validity. This model is known as factorial invariance (Kline, 1998). Millsap & Meredith (2007) said that “CFA is now the primary method for studying factorial invariance (p. 141).

This study presents an application of factorial invariance for investigating construct validity among translated forms of an instrument. As mentioned in Chapter one, when an instrument is translated or administered to different sub groups, there is the assumption that the meaning of the instrument implied in its score is equivalent between the groups or translation. A study of factorial invariance directly investigates this assumption.

Factorial Invariance in Previous Studies

The discussion of factorial invariance in this study leads to the review of previous studies that used factor analysis as a methodology. Factorial invariance requires application CFA and it is well acknowledged in studies that involved comparison. This present study is a comparison study because it is investigating invariance in the factor structure of translated instrument among different cultural groups.

The idea of comparing the responses of two groups on instruments is common. For example, when Brown (2006) asked if “males and female respond to items of a measuring instrument in a similar manner” (p. 236), he suggested a comparison study between male and females. In this study the comparison is not focused on male-female comparison, but rather on individuals responding to alternative forms of different
language versions among different cultural/language groups. The review presented below presents a limited examination of current research investigating factorial invariance in different settings.

Shevlin and Adamson (2005) used factorial invariance to test the factor model of the General Health Questionnaire-12 (GHQ-12) between men and women in a random sample of 5000 households in Northern Inland. The factor model was found to be invariant between men and women. Although this study is an exact application of CFA, it varies from the current study because it specifically focuses on the factor model of the General Health Questionnaire-12 between men and women. Wei, Russell, Mallinckrodt, & Zakalik (2004) examined the factorial invariance and structure means of adult attachment across four ethnic groups. Their study surveyed 2452 university students who were randomly selected based on the registrar’s data base. The groups were defined base on their Ethnicities including African American, Asian American, Hispanic American and Caucasian. Result showed that the invariance exists and suggests that the latent variables asses the same underlying constructs across the four ethnic groups. This cross ethnic-racial study is an obvious application of factorial invariance across different groups. However, it is different than the current study which is aimed to examine the invariant in the latent variables of translated instrument among different cultural groups. Also, as limitation for the study, the researchers mentioned that the result of their study may have been different if they had conducted their study using data from college students who reside in their native home. The current study acknowledges this gap and proposes alternative to overcome this limitation. Another study conducted by Hoelter (1983) presented and tested an alternative explanation for group differences in self-
esteem using the M. Rosenberg and Simmons’ scale. The study used a stratified sample of children in grades 3 through 12 drawn based on race and median income. LISEREL 4 with maximum likelihood was used to estimate the model parameters. The analysis supported the theoretical validity of self-esteem scale. There was invariance among the scale’s factors among the groups. The analysis of mean scores of self-esteem showed that blacks scored higher than white and males are higher than females. The limitation of the study was that the researcher focused on the differences between the groups on self-esteem scale. The similarity between Holter’s study and the current research is that both are applications of validity and factorial invariance. However, the present research was not concern about ethnicity or race differences.

Villarreal, Blozis, & Widaman (2005), presented an instructive study about validity and factorial invariance. They used CFA to evaluate the validity and invariance of the scale that measures the attitudinal familism. In their study, data were collected through phone interviews from a sample drawn randomly from a phonebook. Data were collected in the U.S from the participants who meet the following criteria: origin of a Hispanic/Latino country, and had at least one parent Hispanic/Latino. The researchers used only five items of the attitudinal familism scale. The data were collected in both languages English and Spanish. As demographic information the participants were asked to provide their gender and their level of acculturation. LISREL 8.54 and robust maximum Likelihood was used to estimate the factor loading across the groups. In their study, Villarreal et al. tested for the different types of factorial invariance including weak factorial invariance, and Strong factorial invariance. The same types of factorial are investigated in this study and are introduced later in the section entitled Procedure for
Testing Factorial Invariance. Though Villarreal et al. considered the level of acculturation of the participants; they did not compare the validity of the scale on a group of Spanish who live in their original home.

Although the 3rd edition of Wechsler Intelligence Scale was found valid when applied to children, Maller & Ferron (1997) were concerned about the application of the scale to all children, principally those with hearing disability (deaf children). Therefore, they conducted their study to investigate the validity of the scale when administered to deaf children. The verbal items of the instrument were translated into American Sign Language. The sample consisted of deaf children and standardized sample. Maximum likelihood (ML) estimation and LISREL 7 were used to estimate the parameters. The analysis revealed that the four factors were not invariant across the groups. In other word there are differences across the groups. The study conducted by Maller and Ferron was limited due to the small sample size of the deaf students comparing with the standardization sample.

Another comparison study was conducted by Rettig & Pasamanick (1962) to investigate the factorial analysis between American students and Korean students. The researchers were not seeking for the effect of language or culture on the factor structure of the instrument. They aimed to present the differences in severity of moral judgment between American and Korean students. They used the values judgment scale which was translated into Korean. The instrument consists of 7 factors. The result of their study showed invariance regarding moral judgment among some factors but not among all factors. When the authors discussed the results they mentioned that the translation might have changed the content of the items and that possibly created the variance. They also
said that some of the items were applicable for the Korean students. Though their study has some similarities with the proposed study, this dissertation does not aim to investigate the construct based invariance among different groups but attempts to differentiate failures of the factor structure of translated instrument from actual group differences in cross cultural mono and bilingual groups.

As mentioned earlier factorial invariance is a statistical method that test the construct validity. As an illustration, Brauchle & Azam (2004) conducted a study to evaluate the construct validity of the occupational work ethic inventory. They were looking to compare the factor structures of the occupational work ethic inventory for self-perceived work attitudes of manufacturing employees and their supervisors’ ratings to the same employees. They conducted principal component analysis twice: first to measure the employee’s work attitudes; second to measure supervisor’s opinion about the work attitudes of the same employee. They used the Coefficient of Congruence and the Salient Similarity index (Brauchle & Azam, 2004). The result showed that construct validity of this instrument exists. The authors recommended with confidence the utilization of the instrument because it is valid. Similar, the current study is seeking for construct validity in addition to looking for whether a translated instrument keeps its structure when it is used in different culture without creating bias.

Another study by Milewski, Patelis, & Thanos (2000) addressed the concern of using translated instrument in multiple languages and cultures. Their study was conducted to investigate the invariance of the Advanced Placement International English language exam (APIEL). Their target populations were Chinese and German. Lisrel 8 was used to test for the invariant across the groups. The result indicated one general
APIEL factor and four domains measuring English language proficiency including writing, speaking, listening and reading. They found that all of the domains were invariant across the groups. However, the factor loadings were not invariant across the groups. The authors mentioned that it is difficult to achieve invariant between groups from different culture. Therefore, they recommended further work on examinees from different languages. With that concern, this study becomes an expansion of the study conducted by Milewski et al (2000) in the investigation of factorial invariance.

Factorial Invariance

Ward, Velicer, Rossi, Fava & Prochaska (2004) defined factorial invariance as the similarity of measurement model in different subgroups or across different occasions. However, defining factorial invariance in a set of sentences is questionable. This is because factorial invariance is not an independent concept. Therefore, attention must be given to the confirmatory factor analysis (CFA) and the structural equation modeling (SEM). DeCoster (1998) said that CFA is used to test the factor structure of a set of observed variables in one group or across several groups. It also explains the relationships between a set of dependent variables and a set of continuous latent variables. DeCoster also, specified a set of uses for CFA that make it different than other models. The uses are:

Establish the validity of a single factor model, compare the ability of two different models to account for the same set of data, test the significance of a specific factor loading, test the relationship between two or more factor loadings, test whether a set of factors are correlated or uncorrelated, assess the convergent and discriminant validity of a set of measures (p. 5).
Muthén & Muthén (2009) defined SEM as a combination of a measurement model and a structural model. The measurement model is a CFA multivariate regression model that describes the relationship between the theoretical underlying construct to characteristics of observed dependent variables (indicators). The characteristics include: factor loadings, intercepts, and residuals. In CFA model, factor loadings represent the direct effect of the latent construct on each observed score (Kline, 1998). If the latent construct is standardized then the squared factor loadings represent the proportion of the score variance due to the factor (Brown, 2006). The intercepts represent the expected item responses of someone with a standardized factor score of zero (Bollen, 1989). The residual is the proportion of the observed score variance (Brown, 2006). Testing these components across different groups establishes measurement invariance. The structural part of SEM tests the latent variables (factors) characteristics such as; factor variances, covariances and factor (latent) mean. This is referred to as population heterogeneity (Brown, 2006) or structural invariance. Combining the two tests measurement invariance and then structural invariance, this is known factorial invariance (Kline, 1998). Examination of factorial invariance across multiple groups can be accomplished through Multiple Group CFA (MGCFA). MGCFA is used to understand the measurement invariance and population heterogeneity. However if the researcher wants to investigate the effect of a covariate on both, the measurement and structure invariance, then a Multiple Causes Multiple Indicator (MIMIC) model is necessary (Muthén & Muthén, 2009).

Because factorial invariance can indicate many characters of the dependent variables (indicators) and the latent variables through multiregression tests, it is an
efficient method for testing the validity of the instruments (test, survey). For example, if a researcher administer an instrument to different groups or to one group at different time, the indicator characteristics must remain similar (Dimitrov, 2010). If so the underlying construct has the same theoretical structure among groups or across times. If the indicators properties vary, this means that the indicators are not measuring the construct similarly. Brown (2006, p. 4) defined variance in the indicator properties as “test bias” or “Construct bias”. To illustrate this, he discussed the intelligent quotient (IQ) test between men and women. For example an IQ test would be biased against women if men show a higher latent mean structure compared to woman.

Since this research is intended to study the factor structure of a set of observed variables across different cultural groups, it is an application of factorial invariance MGCFA.

Multiple Group Confirmatory Factor Analysis (MGCFA)

There are two different CFA models that can be used to evaluate the factorial invariance among groups. They are multiple groups CFA (MGCFA) model (with and without mean structure), and multiple indicators, multiple causes (MIMIC) model (Brown, 2006). MGCFA model is accomplished by following the steps as described in (Brown, 2006, p. 270).

Testing for measurement invariance using MGCFA can be conducted either with or without considering means of the latent factor across the multiple groups (Kline, 1998) previously referred to as structural invariance. First, the MGCFA without mean structure
was discussed. Kline (1998) and Brown (2006) distinguished between two MGCFA models: constrained and unconstrained. For example, in a constrained model the unstandardized factor loadings are constrained to be equal across the groups. In the unconstrained model these loadings are freely estimated separately for each group. Measurement invariance can be evaluated by comparing model fit values from the two models. If the fit of the constrained CFA model is not worse than the unconstrained model then the constrained model is applicable for both groups and the factor loadings are considered to be invariant. However, if the constrained model is a worse fit than the unconstrained model then each unstandardized factor loadings should be uniquely estimated with the group. If indicators loadings are individually compared among groups, it may be determined that some of the factors loadings vary across the groups and some do not. This is known as partial invariance according to Kline (2005). This general process is used incrementally to investigate the indicator characteristics: loadings, intercepts and residuals see section entitled Procedure for Testing Factorial Invariance.

Using MGCFA to investigate structural invariance can be accomplished by following the strategy proposed by Sorbom (1974). The strategy consists of two steps. The first step requires fixing the means of all factors to be equal to zero in one of the groups. The constrained group will be used as a reference to estimate the factor means for the rest of the groups. Step two estimates the differences in factor means between the two groups and testing if there is a deviation away from zero. Structural invariance can examine a) invariance in the covariance among latent variables if the instrument is multifactor, b) invariance among the latent factor variances and c) invariance in the latent
factor mean. It is important to note that any examination of structural invariance tests out the validity of the presence of measurement invariance.

To better understand the MGCFA model, let’s assume the following hypothetical study. In a classroom setting, the councilor administers three indicators to measure the relationship of the students to their teacher (relationship latent factor), and two indicators to measure the satisfaction of the teaching methods (satisfaction latent factor). Two sets of hypothesis are to be analyzed: Do the five indicators measure relationship and satisfaction latent factors in the same way for both males and females? If so, is the mean for males and females the same? To answer these two questions, a MGCFA will be initiated in two broad steps. In the first step, (assessing measurement invariance) the measurement model of the five indicator variables to their latent factors will be assessed between the groups. This determines whether the five indicators measure the same two factors in the same way males and females. If a reasonable evidence for partial invariance exists then mean structure (structural invariance) will be added to the CFA model in a second step. MGCFA will be utilized to answer the first two research questions pared in Chapter One.

Covariate Multiple Indicators, Multiple Causes (MIMIC) Modeling

MIMIC Models (multiple indicators/ multiple causes) is an alternative modeling approach for evaluating invariance in multiple groups. Brown (2006) and Muthen & Muthen (2009) suggest that this CFA-MIMIC examine the relationships between the factors and covariates to determine whether measurement invariance and group
heterogeneity exist. According to Brown (2006), the MIMIC model requires two basic steps. First, establish a CFA measurement model. Second, add covariate(s) to the model to examine their direct effects on the latent factors and indicators. The covariate was defined as “a nominal variable that represents levels of known groups such as sex” (Brown, 2006, p. 306).

To answer the third research question MIMIC models with acculturation as a covariate will be investigated for possible mediating effects on the level of measurement or structural invariance in the MGCFA models. Figure 1 depicts this research question.

Ordinal Measures

McDonald (1999) defined an ordinal scale as a “measurement scale in which natural order properties of the attribute are mapped into the number system” (p. 464). Dichotomously-scored test items, likert-scale questionnaire items, and partial-credit polytomous items are examples of ordered-categorical measure (Millsap & Tein, 2004). The confirmatory factor analysis of ordinal variables should not be conducted like it is done with continuous variable (Jöreskog & Moustaki, 2001) because the variable characteristic are related to the ordered thresholds. The thresholds are known as the scale properties, in other words the threshold represent the ranked-ordering numbers of the people responses on the measured latent factor (Embertson & Reise, 2000). Millsap and Tien (2004) have elaborated the basic equations that describe the factor model for ordered-categorical variables. Moreover, according to Millsap and Tien measurement invariance should not only test for invariance among the indictor characteristics (factor
Figure 1. Multiple Group CFA-MIMIC Model
loadings, intercepts and residuals) but also, test for invariance among the thresholds.

According to Millsap and Tien (2004), full measurement invariance exists when the thresholds are invariant among the groups in addition to invariance among the intercepts, the factor loadings, and the unique variances (residuals). They assumed that \( X_{ijg} \) is the score on the \( j^{th} \) ordinal item where \( j=1, \ldots, p \) for the \( i^{th} \) individual where \( i=1, \ldots, n \) in the \( g^{th} \) group where \( g=1, \ldots, k \). The variables are assumed to have a score rank, where \( c \) is the largest possible score and common across the measure. The observed scores \( X_{ijg} \) are assumed to be determined by unobserved scores on the latent variates \( X^{*}_{ijg} \) (underlying observed variable). Equations one and two developed by Millsap and Tien (2004); represent the linear factor model for the latent response variates \( X^{*}_{ijg} \)

\[
X^{*}_{ijg} = v_{jg} + \sum_{l=1}^{q} \lambda_{jlg} \eta_{ilg} + \epsilon_{ijg} \tag{1}
\]

\[
X_{ijg} = c, \text{if } \tau_{jcg} < X^{*}_{ijg} \leq \tau_{jcg+1,g} \tag{2}
\]

In the linear factor model equation (1) \( v_{jg} \) is the intercept, \( \lambda_{jlg} \) is the factor loading of the item \( j \) on the factor \( l \) where \( l=1, \ldots, q \), \( \eta_{ilg} \) is the score of the individual \( i \) on factor \( l \), and \( \epsilon_{ijg} \) is the residual score of the individual \( i \).

Assuming a multivariate normal distribution in the latent response distribution (Joreskog, 2002),

where: \( \mu^*_g \) is \( p \times 1 \) vector of means and \( \sum^*_g \) \( p \times p \) covariance matrix. Thus, the latent response variates in the linear factor model from equation (1) the following equation represents the specified variates:

\[
\text{where,} \tag{3}
\]
\( \tau_{jg} \) is the latent intercept parameter, \( \lambda'_{jg} \) is an \( q \times 1 \) vector of factor loadings for the \( j^{th} \) variable on \( q \) factors, \( \xi_{jg} \) is the \( q \times 1 \) vector of factor scores for the \( i^{th} \) individual in the \( g^{th} \) group. \( \mu_{jg} \) is the \( j^{th} \) unique factor score for the individual.

Assuming multivariate normality the following equations are derived:

\[
\xi_{ig} \sim MNV(\kappa_g, \Phi_g), \quad u_{ig} \sim MVN(0, \Theta_g)
\]

According to Temme (2006), in these equations \( \kappa_g \) is \( q \times 1 \) vector of factor means, \( \Phi_g \) is \( q \times q \) factor covariance matrix. And \( \Theta_g \) is a \( p \times p \) diagonal covariance matrix for the unique factors. If the \( \text{Cov}(\xi_{ig}, u_{ig}) = 0 \) for \( i, g \) this leads to following structure for the means and covariances.

\[
E(X^*_{ig}) = \mu^*_g = \tau_g + \Lambda_g \kappa_g,
\]

\[
\text{Cov}(X^*_{ig}) = \sum^*_g = \Lambda_g \Phi_g \Lambda'_g + \Theta_g \quad \text{where}
\]

\( \tau_{jg} \) = the threshold of the indicators across \( g \) and \( \Lambda_{jg} \) is the \( p \times q \) factor pattern matrix whose \( j^{th} \) row is \( \lambda'_{jg} \).

Equation 2 above represents the model for the observed ordinal items where \( \tau \) is the item threshold parameters that projects the distribution of \( X' \) into \( C \) categories (\( C=0,\ldots, C-1 \)). The lowest value for the threshold is \( \tau_0 = -\infty \) and the highest value is \( \tau_0 = +\infty \). Since the observed value can’t be used to estimate the threshold, constrains need to be placed on the threshold of the response variables distribution. Typically,
constrains in the case of single group are $\mu^*_g = 0$ and $\sum^*_g = 1$ which standardizes the latent response variables. However in the multiple groups case different constrains are adopted. Millsap and Tein (2004) developed the sufficient constrains for indicators with at least three response categories to identify a congeneric factor model:

“For the reference group fix $\mu^*_g = 0$ and Diagonal $\sum^*_g = 1$. These constraints are sufficient to identify all threshold parameters in this group.

Fix $K_g = 0$ in the reference group.

In all groups fix $r_g = 0$ ” (p.485).

For each indicator, require an equality threshold $r_{ig} = r_{jc}$ for all $g$, for this constrains one threshold per latent response variable to be invariant.

After reviewing the mathematical equation developed by Millsap and Tien (2004), the following paragraphs will provide a detailed application of this mathematical equation as a process for evaluating measurement invariance. This study intended to examine only the equivalence of the factor loadings and the intercepts. Brown (2006) suggested that the test of equal unique variances (equal residual) is an optional test. Therefore, the test for equal residual will not be conducted.

Procedure for Testing Factorial Invariance

The procedure for testing measurement invariance requires testing a set of nested hypotheses. As shown in Table 1, for testing factorial invariance starts with a CFA model
for each group involved in the study separately. After establishing a known level of fit of the model to the data, measurement invariance can be tested between groups.

A chi square difference ($\chi^2$) statistic is usually used to judge for measurement invariance models Byrne, et al. (1989b). The configural invariance test is known as a non-constrained baseline model (Brown, 2006).

$$\Delta \chi^2 = \Delta \chi^2_{con} - \Delta \chi^2_{uncon}$$

For instance, if the ($\chi^2$) is significant then the unconstrained model is not sufficient to reject a null hypothesis of equal form therefore invariant is not existent. This means that some items load differently on the factors between the groups (Byrne, Shavelson, & Muthen, 1989a). When the unconstrained model is constrained, then the factor loading for each item should be equal across the groups.

If the difference is significant then the unconstrained model fits the data better than the constrained model indicating a lack of factorial invariance. In this case it is possible to improve the constrained model “by relaxing one or more of the equality constraints” (Cheung & Rensvold, 1999, p. 6) in a predetermined or exploratory iterative process.

The first null hypothesis ($H_{0:1,1}$) which states that there are no differences across the groups in the covariance matrix; that is:

$$H_{0:1,1} = \sum (g^2) = \sum (g^2) = \ldots = \sum (g^2).$$

If the test is not significant then the null hypothesis will not be rejected. Such a result means that equivalence exists across the groups. However, this test is very rigorous
### Table 1

**Procedure for Testing Factorial Invariance**

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Name</th>
<th>Null Hypothesis (H₀)</th>
<th>Test Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test CFA</td>
<td></td>
<td>( H_{0_{\lambda-1}} \sum (\hat{\lambda}^2) = \sum (\hat{\lambda}^2) = \ldots = \sum (\hat{\lambda}^2) )</td>
<td>( \chi^2 )</td>
</tr>
<tr>
<td>Equal Form</td>
<td>Configural Invariance</td>
<td>( H_{0_{\lambda-2}} = \lambda_{form}^{(1)} = \lambda_{form}^{(2)} = \ldots = \lambda_{form}^{(g)} )</td>
<td>( \chi^2_{uncon} )</td>
</tr>
<tr>
<td></td>
<td>Measurement Invariance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal Factor Loadings</td>
<td>Weak Factorial Invariance (metric invariance)</td>
<td>( H_{0_{(1-3)}} = \lambda_j^{(1)} = \lambda_j^{(2)} = \ldots = \lambda_j^{(g)} )</td>
<td>( \Delta \chi^2 = \chi^2_{con} \cdot \chi^2_{uncon} )</td>
</tr>
<tr>
<td>Equal Intercepts</td>
<td>Strong Factorial invariance (scalar invariance)</td>
<td>( H_{0_{(1-4)}} : \tau_j^g = \tau_j^g )</td>
<td>( \Delta \chi^2 = \chi^2_{con} \cdot \chi^2_{uncon} )</td>
</tr>
<tr>
<td>Equal Residuals</td>
<td>Strict Factorial Invariance</td>
<td>( H_{0_{(1-5)}} : \Theta = \Theta^2 )</td>
<td>( \Delta \chi^2 = \chi^2_{con} \cdot \chi^2_{uncon} )</td>
</tr>
<tr>
<td></td>
<td>Population Heterogeneity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal Latent</td>
<td>Equal/Equal Variance/Covariance</td>
<td></td>
<td>( \chi^2_{con} \cdot \chi^2_{uncon} )</td>
</tr>
<tr>
<td>Equal Latent Mean</td>
<td></td>
<td></td>
<td>( \chi^2_{con} \cdot \chi^2_{uncon} )</td>
</tr>
</tbody>
</table>

*Note. All symbols, subscripts and superscripts are defined in text where relevant*
because it is not expected that the groups to be invariant at this level unless the groups are dawn randomly from the same population (Cheung & Rensvold, 1999).

The second null hypothesis tests for configural invariance. This requires testing the pattern of factor loadings and postulates that there are no differences in the factor loading, of the variables and their construct between the groups. In another word, items cluster similarly under the same factor, between the groups. The equation below represents the test of configural invariance where, $\lambda$ refers to the number of the factor patterns on the instruments across the $g^{th}$ groups.

$$H_{0_{k-1}} = \lambda_{f_{1}}^{(1)} = \lambda_{f_{2}}^{(2)} = \cdots = \lambda_{f_{g}}$$

The third null hypothesis tests for weak factorial invariance (metric invariance). This is a test for equality of factor loading between the groups. It is represented with the following hypothesis:

$$H_{0_{k-1}} = \lambda_{j_{1}}^{(1)} = \lambda_{j_{2}}^{(2)} = \cdots = \lambda_{j_{g}}$$ where,

$\lambda_{j}^{(1)}$ refers to the factor loading of the $j^{th}$ item on the latent variable in the group1 of the instrument should equal the factor loading of the $j^{th}$ item on the latent variable in group 2.

A chi square difference ($\chi^2$) statistic is usually used to judge for measurement invariance models Byrne, et, al. (1989b). The configural invariance test is known as a non-constrained baseline model (Brown, 2006).
\[ \Delta \chi^2 = \Delta \chi^2_{\text{con}} - \Delta \chi^2_{\text{uncon}} \]

For instance, if the \((\chi^2)\) is significant then the unconstrained model is not sufficient and invariant is not existent. This means that some items load differently on the factors between the groups (Byrne, et al., 1989a). When the unconstrained model is constrained, then the factor loading for each item should be equal across the groups. If the difference is significant then the unconstrained model fits the data better than the constrained model indicating a lack of factorial invariance. In this case it is possible to improve the constrained model “by relaxing one or more of the equality constraints” (Cheung & Rensvold, 1999, p. 6) in a predetermined or exploratory iterative process.

The fourth null hypothesis is testing for strong factorial invariance. The null hypothesis states that there are no differences among the intercepts of like items between groups as the equation below shows:

\[ H_{0_{1-4}}: \tau_i^g = \tau_i^{g'} \]

Failing to reject the null hypothesis is viewed as evidence that invariant exist in the indicator intercepts.

If the model showed a strong factorial invariance, that means if the model is invariant in the factor loading and intercepts, then the error variance of the indicator is not necessary invariant. Therefore a test for the invariant of the indicator's error variance is required.
The fifth null hypothesis is testing for the indicators error variance as the equation below shows:

\[ (H_{0_{1-6}}: \Theta^1 = \Theta^2) \]

Failing to reject the null hypothesis means that there is invariance among the groups in other words, there is a strict factorial invariance. As mentioned earlier and according to Brown (2006), this test is optional. Thus, this test was not conducted in this study.

Once strong measurement invariance is established, meanings that the items describing the measurement of the latent construct show similar psychometric properties among or between the groups, consideration of the structural properties among the latent variables can meaningfully proceed also referred to population heterogeneity. In multi factor instruments this would include examining the covariances among the factors across the groups; \( H_{0_{1-6}} = \phi_{11}^{(1)} = \phi_{11}^{(2)} \). Followed by testing the latent variable variance; \( H_{0_{1-6}} = \phi_{11}^{(1)} = \phi_{11}^{(2)} \). Lastly, examination of the latent trait means; \( H_{0_{(1-7)}} = \xi_{z1}^{(1)} = \xi_{z2}^{(2)} \).

Examination of both measurement and structural invariance must be undertaken to ensure correct interpretation of latent mean comparisons among different groups. However in this invariance study only single factor, congeneric measurement models are examined so the examination of population heterogeneity is limited to the equality of latent means.

Thus, the last two null hypotheses in Table 2.1 that represents the tests of structural invariance (population heterogeneity). Failing to reject the null hypothesis means that there is a structural invariance between the groups. To better understand the
symbols used in this chapter, Table 2 represent the labels of the symbols used in the equations.

Table 2
Symbols

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Labels</th>
</tr>
</thead>
<tbody>
<tr>
<td>g</td>
<td>Group number</td>
</tr>
<tr>
<td>(\lambda)</td>
<td>Factor Loading</td>
</tr>
<tr>
<td>j</td>
<td>Item</td>
</tr>
<tr>
<td>i</td>
<td>Individual</td>
</tr>
<tr>
<td>(\chi^2)</td>
<td>Chi square statistics</td>
</tr>
<tr>
<td>(\tau)</td>
<td>Intercept (the mean)</td>
</tr>
<tr>
<td></td>
<td>Error variance</td>
</tr>
<tr>
<td>k</td>
<td>The infinite number of groups</td>
</tr>
<tr>
<td>n</td>
<td>The infinite number of individuals</td>
</tr>
<tr>
<td>(H_0)</td>
<td>Null hypothesis</td>
</tr>
<tr>
<td>(\Sigma)</td>
<td>Summation</td>
</tr>
<tr>
<td>(\Phi)</td>
<td>Latent Variance</td>
</tr>
<tr>
<td>(\xi)</td>
<td>Latent mean</td>
</tr>
</tbody>
</table>

Acculturation

Acculturation is an important element to be considered in any cross cultural setting or research endeavor, and it seems to be unavoidable because we all live in a global village where physical boarders are less prominent due to the median and the internet, etc. In his time, Plato suggested that visitors from other cities be restricted to
the port to minimize “cultural contamination.” Such advice sounds absurd today since
city borders no longer exist due to communication technologies and population
migration. Consequently every culture is being “contaminated” by others. Acculturation
affects all people, for example, the psychologist Rudmin (2003) writes: “When peoples
of different cultures interact and intermix, they have some probability of adopting each
other’s products, technologies, behaviors, languages, beliefs, values and social
institutions” (Introduction, para. 1). As a result there are many studies in the literature
examining acculturation and its effects. There are numerous studies that examine
acculturation on the family members’ relationships. For instance Bornstein and Cote
(2006) studied the acculturation and parent-child relationships. The motivation that led
them to conduct their study was that previous research on parent-child relationships are
not applicable to new generations because they are more exposed to other cultures.
Another study by Barber, Cook, and Ackerman (1985) was conducted to investigate the
effect of acculturation on attitudes of filial responsibility among Navajo youth. The aim
of their study was to investigate the multidimensional nature of acculturation, and to test
the hypothesis that acculturation is negatively associated with attitudes of filial
responsibility (Barber, Cook, & Ackerman, 1985). Their result did not support the
hypothesized negative relationship between level of acculturation and attitudes toward
filial responsibility. There are many others studies devoted to acculturation that one could
exhibit here.

Although there are investigators who considered acculturation as a variable that
may affects people’s behaviors and linguistics still there is a gap in the literature
regarding acculturation and validity of translated documents. For example, Bosher (1997)
conducted a study that investigated the cultural identity of second generation immigrants to the United States. The author was seeking to understand the relationships among the acculturation, ethnicity, native language maintenance, and self-esteem. However, Bosher’s study and other similar research studies failed to consider acculturation as a variable that may affect the validity of their translated instrument. Therefore, it is important to investigate the extent acculturation affects peoples’ understanding of a translated document. In other words ‘Does acculturation have an effect on translated documents? This is the second focus of this study.
CHAPTER III

METHODOLOGY

This chapter presents the methodology: including a description of the sample, instrumentation, data collection procedures and the statistical analysis used to answer the research questions developed in chapter I and are restated here:

1. What level does measurement invariance exist between an original and translated instrument among mono- and bilingual samples?
2. If measurement invariance exists, does invariance extend to structural invariance among the mono- and bilingual samples?
3. If measurement or structural invariance does not exist, does the respondent’s level of acculturation mediate the level of invariance?

Instruments

Two instruments were used to collect data from the described samples. These two instruments are The Belief in Personal Control Scale (BPCS) and The Bidimensional Acculturation Scale (BAS). Data from the BPCS was used to examine the first and research questions. The BAS was BPCS to examine the third research question.
The Belief in Personal Control Scale Revised (BPCS)

According to Berrenberg (1987) the BPCS consists of 45 items hypothesized to form three factors: General External Control (GEC), a measure of an individual’s belief that his/her outcomes are self-produced (internally) or produced by the fate or others (externally); Exaggerated Control Dimension (ECD), the extreme and unrealistic belief in personal control; and God Mediated Determinant (GMD), a measure of the belief that God can be enlisted in the achieved desired outcomes. All of the components are measured on a 5-point Likert Scale (1= always true, 2= often true, 3= sometimes true, 4= rarely and 5= never true). The BPCS has shown adequate reliability in previous research alpha of 0.85 for the General External Control; 0.88 for Exaggerated Control, and 0.97 for God Mediated (Berrenberg, 1987). Furthermore, it has shown excellent construct validity, correlating with similar measures such as Internal-External Locus of Control, the Tailor Manifest Anxiety Scale, the Feelings of Inadequacy Scale, and the Mania and Depression Scale. Although the 45 items of the BPCS were administered, only the data on the GMD factor were considered in the analysis.

The Bidimensional Acculturation Scale (BAS)

The BAS developed by Marin & Gamba (1996) is a 24-item survey that theoretically measures three language-related factors related to acculturation: “the language use scale (items 1-6), the linguistic proficiency subscale (items 7-18); and the
electronic media subscale (items 19-24). The response categories for the items 1-6 and 19-24 are ‘almost always’ = 4; ‘often’ = 3; ‘sometimes’ = 2 and ‘almost never’ = 1. The response categories for items 7-18 are ‘very well’ = 4; ‘well’ = 3; ‘poorly’ = 2 and ‘very poorly’ = 1” (p. 101). The BAS was originally created to measure the acculturation between Hispanic and non-Hispanic people. To norm and score the instrument, it was tested on a random sample of 254 adult Hispanic residents of San Francisco, California who were interviewed over the telephone. BAS also showed adequate internal reliability for the Hispanic group, (alpha=0.90) and non-Hispanic group (alpha=0.96) (Marin & Gamba, 1996). Although the reliability was provided, no validity information was provided about the correlation values. However, it was mentioned that construct validity was established by correlating subscales and the combined overall score with variables used previously by researchers developing other acculturation scales but no specific values were available. Only the linguistic proficiency was used in this study.

Study Groups

Four different language/cultural groups were recruited for this study, each group is described below. Two of the groups were identified as native speakers: native Arabic speakers and native American English speakers. Two groups were comprised of English and Arabic bilingual speakers. Specifically, American English speakers who are living or have lived in Arabic society, or Americans who are learning or speak the Arabic language. Similarly, Arab participants must be living or have lived in the USA or Arab
participants who are learning English. The four different groups described are as follows: American Native English speakers (A-NES), Arab Native Arabic Speakers (A-NAS), American bilingual speakers (Am-BS), and Arab Bilingual speakers (Ar-BS).

Convenience samples of participants were recruited for all groups. Table 3 shows the total sample of participants (N=720) recruited from different universities and colleges in the United States and two Arabic speaking countries (Kingdom of Saudi Arabia and Palestine) broken down by study group. All participants from group A-NES, group Am-BS, and group Ar-BS were recruited from the USA. The participants of group A-NAS (n=320) were recruited from two Arabic speaking countries: Palestine (n=200) and the Kingdom of Saudi Arabia (n=120). Table 3 also shows the proportion of the participants who responded to different instruments among the four groups. Among the 25 individuals who make up the Am-BS, 22 responded to the English form of the BPCS, 13 responded to the Arabic version and 13 responded to the acculturation survey. Within the Ar-BS group, 152 participants responded to the English form of the BPCS, 126 responded to the Arabic form of the BPCS and 124 responded to the BAS.

Table 3

Demographic of Sample Responses to the Instruments by Site Recruitment

<table>
<thead>
<tr>
<th>Groups</th>
<th>Site of Participants</th>
<th>English BPCS</th>
<th>Arabic BPCS</th>
<th>Acculturation BAS</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-NES</td>
<td>USA</td>
<td>200</td>
<td>-</td>
<td>-</td>
<td>27.78</td>
</tr>
<tr>
<td>A-NAS</td>
<td>Saudi Arabia &amp; Palestine</td>
<td>-</td>
<td>320</td>
<td>-</td>
<td>44.45</td>
</tr>
<tr>
<td>Am-BS</td>
<td>USA</td>
<td>22</td>
<td>13</td>
<td>13</td>
<td>3.47</td>
</tr>
<tr>
<td>Ar-BS</td>
<td>USA</td>
<td>152</td>
<td>126</td>
<td>124</td>
<td>24.30</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>374</td>
<td>359</td>
<td>137</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Due to the small number of participants, the group Am-BS was not included in any of the primary analysis of the research question.

**Instrument Translation**

In cross-cultural research, such as it is in the present study, it is important that the different forms of an instrument be similar in all aspects, including item meaning as well as the response scale of (Cheung & Rensvold, 1999). Therefore, the BPCS and BAS instruments were translated using a blind back-translation by two experts fluent in both languages (English and Arabic). This strategy requires two translations of the same document. The first expert performed a translation of the original documents (English versions) to the Arabic language. Then, the second person, with no previous knowledge of the original documents translated them back to their original language (Brislin, Lonner, & Thorndike, 1973). After translation, the two translators met to review the two translated versions of the instrument. The items were discussed in terms of linguistics rules to set the final version which was used in the study. A last step was conducted by submitting the Arabic versions to another professional university faculty who teaches Arabic for grammatical revisions. The Final forms of the surveys that were used for this study are shown in Appendixes D.
Sample Demographics

For the purpose of sample description a set of demographic questions were asked following instrument administration. These variables are not part of the theoretical model designed for this study. Participants were asked to report their gender, age, educational level and if they are bilingual or not. Bilingual participants were also asked to list the languages that they could read. A-NES and Am-BS participants were also asked if they had been in an Arabic country. If they answered yes, they were also asked to list the number of years and months they spent in those countries. A-NAS participants were asked if they had been in a country where English is the primary spoken language. If they answered yes, they were also asked to list the number of years and months they spent in those countries. Ar-BS participants were asked to list the number of years or months they had been in the USA. Essentially, it is assumed that the more the participant lives in a host country, the more acculturated she/he becomes (Franco, Cuadra, Tabol, Zea, & Peterson, 1998). Table 27 in Appendix A represents the raw information of the sample demographics.

Procedures and Participant Recruitment

Because of time limits and financial constraints, convenient samples were chosen for this study. Participants included only college students. Several reasons, including the following, motivated these limitations. First, it is assumed that it is more likely to find
college students speaking both English and Arabic than it could be in a general population. The second reason is related to Institutional Review Board (IRB) compliance. College students are adults and their recruitment will not require special permission such as special authorization to recruit minors. The participants of the groups American-NES, Am-BS and Ar-BS were chosen from different universities and colleges in Michigan and Illinois where the Arabic language is taught. The A-NAS were chosen from two Arabic universities in two Arabic countries: King Khaled University in Kingdom of Saudi Arabia and Bethlehem University in Palestine. Every targeted school was contacted with a recruitment request after the study was presented to appropriate institutional authorities. When it was required by a university a specific separate approval from the Human Subject of Institutional Research (HSRIB) was obtained before data collection. The Initial Approval letter obtained from the WMU IRB is shown in Appendix F.

US universities were contacted for recruitment include Michigan State University, University of Michigan, Western Michigan University, Kalamazoo Valley Community College, The Henry Ford Community College and the University of Chicago, participants were only from Michigan State University, University of Michigan, Kalamazoo Valley Community College, Western Michigan University, and the University of Chicago. Once a university approved the data collection procedures, the researcher went and identified a public location where the participants were recruited. For example, most of the universities recommended public locations such as break rooms in linguistic departments and other known locations where international students meet. In the community colleges, the recommendations were to recruit participants during their
multicultural and foreign language classes. This was done with the collaboration of their respective course instructors.

Because of the potential difficulty in recruiting participants for this study, several survey methods were combined; specifically email and postal surveys. Once potential individuals were identified, they were contacted and asked whether they would like to participate in the study. If they responded positively a consent letter and the survey was mailed, first class, with return postage. In the case of the email survey, an email was sent to potential participants to request their participation. They were provided with a survey which included a consent letter to participate. In addition, some participants were contacted face-to-face with hard copies of the survey and consent forms to complete.

The participants for the group A-NAS were recruited in two Arab universities selected from the Kingdom of Saudi Arabia and Palestine. The procedure of recruitment and data collection were conducted by two research confederates from the targeted countries. Each of the volunteers received training in confidentiality and data collection. Data collection from foreign sites started only after the confederates were approved by the Human Subject of Institutional Research office at Western Michigan University.

Participants in the A-NES answered the original form of the BPCS instrument. A-NAS participants answered the translated form (Arabic) of the BPCS. The Am-BS and Ar-BS answered both English and the translated form (Arabic) of the BPCS. In addition, the groups Am-BS and Ar-BS were administered the BAS survey translated into Arabic in the group Ar-BS. Figure 2 presents a stylized administration of the instruments among
the groups. However, the number of participants of the Am-BS is insufficient for statistical analysis. Therefore Am-BS was omitted from further consideration.

Figure 2. Instrument Administration Protocol for Each of the 4 Sample Groups

Data Analysis

Because this study required four different language/cultural groups and because of the different methods used to collect data, all data collected were aggregated into
different databases; Microsoft Access Database and Adobe PDF Professional Form. The following steps describe the process for creating the final dataset:

The collected hard forms of the survey were manually entered in different Access datasets with respect to the groups described earlier. Adobe PDF forms received via email were automatically imported and compiled into a master file that was exported to Microsoft Access datasheet then merged with the corresponding Access database.

The datasets obtained from each group were imported independently into SAS 9.2. The four SAS datasets were merged to create a unique dataset that is later used to create an output text for subsequent Mplus. All SAS programs are presented in Appendix C and Mplus scripts are in Appendix D.

Data Preparation

Within the SAS common data set, variables were examined for missing responses or any other anomalies such as data point that would be incoherent with the possible options. In case incoherencies were found, data were double checked against the original responses provided by the participant and corrected. All independent variables were examined for missingness as they are important to identify the participant’s location among the groups.

Once data were verified against the original hard copies, a comprehensive analysis of BPCS GMD factor was initiated. For example, Tables 4, 5, 6, and 7 present items amount of missingness in the BPCS within each group and the efficiency of the
imputation discussed below. The Eff column represents the relative efficiency of imputation. According to Rubin (1987) this estimated value in units of variance (the relative efficiency) is approximately a function of missing information (p.114).

Table 4
Descriptive Statistics on Missingness in A-NES Before and After Imputation

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>(\bar{X})</th>
<th>SD</th>
<th>n *</th>
<th>(\bar{X})</th>
<th>SD</th>
<th>Eff</th>
</tr>
</thead>
<tbody>
<tr>
<td>it5</td>
<td>198</td>
<td>2.49</td>
<td>1.54</td>
<td>200</td>
<td>2.51</td>
<td>1.54</td>
<td>0.02</td>
</tr>
<tr>
<td>it9</td>
<td>198</td>
<td>3.14</td>
<td>1.49</td>
<td>200</td>
<td>3.15</td>
<td>1.48</td>
<td>0.00</td>
</tr>
<tr>
<td>it14</td>
<td>199</td>
<td>2.83</td>
<td>1.58</td>
<td>200</td>
<td>2.84</td>
<td>1.57</td>
<td>0.00</td>
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<tr>
<td>it22</td>
<td>198</td>
<td>3.09</td>
<td>1.51</td>
<td>200</td>
<td>3.11</td>
<td>1.51</td>
<td>0.01</td>
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<tr>
<td>it31</td>
<td>196</td>
<td>2.85</td>
<td>1.58</td>
<td>200</td>
<td>2.86</td>
<td>1.58</td>
<td>0.01</td>
</tr>
<tr>
<td>it36</td>
<td>197</td>
<td>3.05</td>
<td>1.56</td>
<td>200</td>
<td>3.06</td>
<td>1.55</td>
<td>0.00</td>
</tr>
<tr>
<td>it39</td>
<td>198</td>
<td>3.33</td>
<td>1.40</td>
<td>200</td>
<td>3.34</td>
<td>1.40</td>
<td>0.01</td>
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<tr>
<td>it44</td>
<td>198</td>
<td>3.20</td>
<td>1.45</td>
<td>200</td>
<td>3.21</td>
<td>1.45</td>
<td>0.01</td>
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</table>

Table 5
Descriptive Statistics of Missingness in A-NAS Before and After Imputation

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>(\bar{X})</th>
<th>SD</th>
<th>n *</th>
<th>(\bar{X})</th>
<th>SD</th>
<th>Eff</th>
</tr>
</thead>
<tbody>
<tr>
<td>it5</td>
<td>319</td>
<td>1.36</td>
<td>0.74</td>
<td>320</td>
<td>1.36</td>
<td>0.74</td>
<td>0.00</td>
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<tr>
<td>it9</td>
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<td>0.78</td>
<td>320</td>
<td>1.29</td>
<td>0.78</td>
<td>0.00</td>
</tr>
<tr>
<td>it14</td>
<td>319</td>
<td>1.33</td>
<td>0.77</td>
<td>320</td>
<td>1.33</td>
<td>0.77</td>
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<td>it22</td>
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<td>0.89</td>
<td>320</td>
<td>1.47</td>
<td>0.89</td>
<td>0.01</td>
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<td>it31</td>
<td>318</td>
<td>1.59</td>
<td>0.96</td>
<td>320</td>
<td>1.59</td>
<td>0.96</td>
<td>0.00</td>
</tr>
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<td>it36</td>
<td>315</td>
<td>1.57</td>
<td>0.98</td>
<td>320</td>
<td>1.57</td>
<td>0.97</td>
<td>0.00</td>
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<td>it44</td>
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<td>1.38</td>
<td>0.81</td>
<td>320</td>
<td>1.39</td>
<td>0.81</td>
<td>0.00</td>
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</tbody>
</table>
### Table 6

Descriptive Statistics of Missingness in Ar-BS (Arabic Version) Before and After Imputation

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>( \bar{X} )</th>
<th>SD</th>
<th>n *</th>
<th>( \bar{X} )</th>
<th>SD</th>
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</tr>
</thead>
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<tr>
<td>it_A5</td>
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<td>0.87</td>
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<td>-0.01</td>
</tr>
<tr>
<td>it_A14</td>
<td>123</td>
<td>1.37</td>
<td>0.88</td>
<td>116</td>
<td>1.36</td>
<td>0.88</td>
<td>-0.01</td>
</tr>
<tr>
<td>it_A22</td>
<td>122</td>
<td>1.50</td>
<td>1.01</td>
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<td>-0.02</td>
</tr>
<tr>
<td>it_A31</td>
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<td>0.96</td>
<td>116</td>
<td>1.46</td>
<td>0.97</td>
<td>0.00</td>
</tr>
<tr>
<td>it_A36</td>
<td>123</td>
<td>1.73</td>
<td>1.21</td>
<td>116</td>
<td>1.74</td>
<td>1.22</td>
<td>0.01</td>
</tr>
<tr>
<td>it_A39</td>
<td>122</td>
<td>2.25</td>
<td>1.57</td>
<td>116</td>
<td>2.25</td>
<td>1.58</td>
<td>0.00</td>
</tr>
<tr>
<td>it_A44</td>
<td>124</td>
<td>1.54</td>
<td>1.02</td>
<td>116</td>
<td>1.53</td>
<td>1.03</td>
<td>-0.01</td>
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</tbody>
</table>

### Table 7

Descriptive Statistics of Missingness in Ar-BS (English Version) Before and After Imputation

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>( \bar{X} )</th>
<th>SD</th>
<th>n *</th>
<th>( \bar{X} )</th>
<th>SD</th>
<th>Eff</th>
</tr>
</thead>
<tbody>
<tr>
<td>it_E5</td>
<td>148</td>
<td>1.43</td>
<td>1.00</td>
<td>116</td>
<td>1.51</td>
<td>1.08</td>
<td>0.08</td>
</tr>
<tr>
<td>it_E9</td>
<td>149</td>
<td>1.63</td>
<td>1.13</td>
<td>116</td>
<td>1.62</td>
<td>1.13</td>
<td>-0.01</td>
</tr>
<tr>
<td>it_E14</td>
<td>151</td>
<td>1.55</td>
<td>1.12</td>
<td>116</td>
<td>1.62</td>
<td>1.22</td>
<td>0.07</td>
</tr>
<tr>
<td>it_E22</td>
<td>149</td>
<td>1.60</td>
<td>1.05</td>
<td>116</td>
<td>1.63</td>
<td>1.08</td>
<td>0.03</td>
</tr>
<tr>
<td>it_E31</td>
<td>150</td>
<td>1.61</td>
<td>1.05</td>
<td>116</td>
<td>1.72</td>
<td>1.16</td>
<td>0.10</td>
</tr>
<tr>
<td>it_E36</td>
<td>148</td>
<td>1.92</td>
<td>1.31</td>
<td>116</td>
<td>2.00</td>
<td>1.38</td>
<td>0.08</td>
</tr>
<tr>
<td>it_E39</td>
<td>146</td>
<td>2.47</td>
<td>1.40</td>
<td>116</td>
<td>2.47</td>
<td>1.44</td>
<td>-0.01</td>
</tr>
<tr>
<td>it_E44</td>
<td>150</td>
<td>1.91</td>
<td>1.18</td>
<td>116</td>
<td>1.86</td>
<td>1.19</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

Missing data analysis was performed to determine if the data were missing at random (MAR) (Rubin, 1987). Detection is based on simple regression which predicts the missing on variable on a criterion Y from an independent variable vector (Dow & Eff, 2009). For this purpose, the independent variables “age,” “educational level” and “gender” were selected. The items of GMD were selected as dependent variables defined by each group independently. However, only the independent variable “gender” was considered due to incomplete missing data on “age” and “educational level”.

81
In order to test the null hypothesis that, there are no differences between the participants who gave their gender and those who did not as related to the items, the two variables were coded for missing and non missing values (missing=0, non missing=1). Independent t-tests were produced, see Table 8. Data analysis revealed that there was no statistically difference between responders and non responders indicating that the missingness among the four groups is consistent with a MAR pattern.

Table 8
T-Test for Difference between Respondents and Non Respondents for Item1 - Item45 Based on Gender

<table>
<thead>
<tr>
<th>Groups</th>
<th>Method</th>
<th>Variances</th>
<th>df</th>
<th>t-Value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group1</td>
<td>Pooled</td>
<td>Equal</td>
<td>198</td>
<td>0.77</td>
<td>0.44</td>
</tr>
<tr>
<td>Group2</td>
<td>Pooled</td>
<td>Equal</td>
<td>318</td>
<td>-0.58</td>
<td>0.56</td>
</tr>
<tr>
<td>Group4a</td>
<td>Pooled</td>
<td>Equal</td>
<td>123</td>
<td>0.53</td>
<td>0.59</td>
</tr>
<tr>
<td>Group4e</td>
<td>Pooled</td>
<td>Equal</td>
<td>150</td>
<td>-1.19</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Dow and Eff (2009) said that deleting data in cross-cultural survey research is a problem because deleting data decreases the sample size and may significantly reduce the statistical power. A simple known method is mean imputation. Using mean imputation requires replacing the missing observation with the mean of the non-missing observations for that variable as suggested by Patzer (2009). According to Patzer, “there are disadvantages of mean imputation method because the uniqueness of the subject that was lost becomes “normal” when mean imputation is used. Also, this method ignores non response bias and can lead to incorrect statistical assumptions” (p. 14). Therefore, E-M
Algorithm – Expectation-Maximization Algorithm method – was used to impute the data in this current study. According to Cappé and Moulines (2009), the E-M imputation is an interactive procedure that uses other variables to impute an expected value, then proceed a maximization by checking if whether that value is most appropriate. If not, another value is imputed following the same procedure until a more suitable value is found. By doing so this E-M imputation preserves the relationship between the variables. This is important in this study since factorial invariance method is actually studying the relationships among set of variables.

In this study, SAS 9.2 Proc MI was used to impute the missing data at the level of the item in the BPCS and BAS. Each group was imputed independently. Following imputation all data merged into one dataset. The imputed data shows an extremely high relative efficiency with a mean of the parameter estimates within the 95% confidence interval.

Model Estimation

The software Mplus version 6.1 was used to estimate the MGCFA models. Muthen & Muthen (2009) defined Mplus as “a statistical modeling program that provides researchers with a flexible tool to analyze their data. Mplus allows all analysis of both cross-sectional and longitudinal data single-level and multiple-level. Nominal or ordinal data could be analyzed by Mplus. It also has special features from missing data, and complex data” (p. 1).
Maximum Likelihood (ML) and Weighted Least Square (WLS) are common estimation methods used in single group studies. These methods are also appropriate in multiple group studies (K. G. Joreskog, 2002). However in this study ML should not be used because the items on the BPCS and BAS are measured on an ordinal scale. ML requires a multivariate normality which is not the case in this study (Brown, 2006). It is widely noted in the literature that WLS or robust weighted least squares (WLSMV) is recommended as an estimator models with non normal data or ordinal indicators. Neither WLS nor WLSMV does require the multivariate normality distribution assumption (Muthén & Muthén, 2009). However, WLS utilize estimation of a weight matrix which generally requires very large samples even for a moderate number of indicators in order to achieve reasonable standard error estimation (Brown, 2006). Many structural equation programs require that the weight matrix be inverted during model situational fit. Without very large samples, the weight matrix found results in a singular matrix resulting in model estimation failure from an incomplete solution. This was well illustrated by Yoon (2007). He said that WLS “involves the inverse of a large weight matrix” (p. 20). Also Brown (2006), Flora and Curren (2004) mentioned that WLS requires a large sample size because WLS estimation depend on the variances and covariances of the matrix elements. According to Brown, the sample size should be greater than \( b + p \) where \( b = p( p + 1)/2 \) and \( p \) is the number of the observed variables. So, it would be expected that a very large sample size would be needed whenever there are more than a few indicator variables, as in the current study. For example, in this study the BPCS instrument consists of 45 variables distributed on three factors. The latent factors are
defined by 18, 17, and nine variables consequently. However, only the latent factor GMD of eight items was considered for the analysis. Following the mathematical equations considered by Brown the sample size will be: $W = b \times b$ where $W$ represent the weight matrix, $(8 \times 9) \div 2 = 36$ and $W$ is of the order $b \times b$, $(36 \times 37) \div 2 = 666$ elements. However, WLSMV estimation provides robust standard errors and adjusted chi-square test statistics (Brown, 2006). Flora and Curren (2004) said that WLSMV is a good estimate with a small sample size, model complexity, and in the absence of normality. WLSMV as implemented in Mplus does not require that $W$ to be inverted during estimation but, requires the sample size to be larger than the number of rows in $W$.

Testing Factorial Invariance

Figure 3 describes the procedures for testing factorial invariance for the measure in this study. The figure consists of two phases; the first phase represents the methods of data collection which will be defined in details in Chapter III. The lower phase represents the four main tests for measurement invariance; configural factorial invariance, weak factorial invariance, strong factorial invariance, and strict factorial invariance which will not be conducted in this study.

The underlying assumption about the instrument in this study is that the responses on the instrument’s items have the same factor loading across the groups and that the items have similar variance covariance matrix when CFA is conducted separately for each group. This test is known as “Equivalent measurement” (Drasgow & Kanfer, 1985).
Figure 3. Process of Data Collection and Data Analysis
Therefore, before attempting any test for measurement invariance which is the main interest of this research, a test of equivalence measurement was conducted.

Testing factorial Invariance requires testing several null hypothesis as suggested by Muthén & Muthén (2009), Brown (2006), and Meredith (1993) as follow:

Part –A  Measurement Invariance

1. Test CFA separately in each group \( H_{0_{1-4}} = \sum (g^1) = \sum (g^2) = \ldots = \sum (g^n) \)
2. Conduct the simultaneous test of equal form (Identical factor structure, configural invariance) \( H_{0_{0-2}} = \lambda_{form}^{(1)} = \lambda_{form}^{(2)} = \ldots = \lambda_{form}^{(g)} \)
3. Test the equality of factor loading (weak factorial invariance) \( H_{0_{0(1-3)}} = \lambda_j^{(1)} = \lambda_j^{(2)} = \ldots = \lambda_j^{(g)} \)
4. Test the equality of indicator intercept (strong factorial invariance) \( H_{0_{0-4}} : \tau_1^g = \tau_1^g \)
5. Test the equality of the indicator residual variances (strict factorial invariance) (optional) \( H_{0_{0-5}} : \Theta^1 = \Theta^2 \)

Part-B Structural Invariance

6. Test the equality of factor variances.
7. Test the equality of factor covariances if applicable.
8. Test the equality of latent means.

The eight-steps-procedure described above is summarized in Table 1 in Chapter Two. This procedure will be followed in the next chapter to test for factorial invariance across the groups.
CHAPTER IV

RESULTS

This study investigated the factorial invariance of translated instruments in mono- and bilingual samples. Results are organized by the research questions: (1) To what level does measurement invariance exist between an original and translated instrument among mono- and bilingual speakers; (2) If measurement invariance exists, does invariance extend to structural invariance among the mono- and bilingual speakers; (3) If measurement or structural invariances does not exist, does the respondent’s level of acculturation mediate the level of invariance?

The procedures for testing factorial invariance were described in the previous chapter. A test for equal form of the congeneric model, equal factor loading, and equal intercepts were conducted in sequence to answer the first research question. This was followed by a test for equal factor variance then equal latent means to answer the second research question. Multiple groups- MIMIC model was conducted to answer the last question. The Satorra Bentler Chi-Square test $\chi^2$, the Root Mean Square Error of Approximation (RSMA), Comparative Fit Index (CFI), and Tucker Lewis Index (TLI) were used to evaluate the all model fits and a chi-square difference test was used to compare nested models. The following criterion values suggested by Hu & Bentler (1999) and Brown (2006) were used in this study: RMSA less than or equal to .06, CFI $\geq$ 0.95, and TLI $\geq$ 0.96.
Descriptive Statistics

Descriptive statistics for the GMD factor of the BPCS and linguistic proficiency factor of the BAS are presented in Tables 9, 10, 11, 12 and 13. There tables present the data as if each item were measured continuously items were in fact measured ordinaly, thus frequency distributions for these items are presented in Appendix B.

Table 9
Descriptive Statistics of the Items in Group A-NES (N=200)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>it5</td>
<td>2.51</td>
<td>1.54</td>
</tr>
<tr>
<td>it9</td>
<td>3.15</td>
<td>1.48</td>
</tr>
<tr>
<td>it14</td>
<td>2.84</td>
<td>1.57</td>
</tr>
<tr>
<td>it22</td>
<td>3.11</td>
<td>1.51</td>
</tr>
<tr>
<td>it31</td>
<td>2.86</td>
<td>1.58</td>
</tr>
<tr>
<td>it36</td>
<td>3.06</td>
<td>1.55</td>
</tr>
<tr>
<td>it39</td>
<td>3.34</td>
<td>1.40</td>
</tr>
<tr>
<td>it44</td>
<td>3.21</td>
<td>1.45</td>
</tr>
</tbody>
</table>
Table 10  
Descriptive Statistics of the Items in Group A-NAS (N=320)  

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>it5</td>
<td>1.36</td>
<td>0.74</td>
</tr>
<tr>
<td>it9</td>
<td>1.29</td>
<td>0.78</td>
</tr>
<tr>
<td>it14</td>
<td>1.33</td>
<td>0.77</td>
</tr>
<tr>
<td>it22</td>
<td>1.47</td>
<td>0.89</td>
</tr>
<tr>
<td>it31</td>
<td>1.59</td>
<td>0.96</td>
</tr>
<tr>
<td>it36</td>
<td>1.57</td>
<td>0.98</td>
</tr>
<tr>
<td>it39</td>
<td>1.90</td>
<td>1.32</td>
</tr>
<tr>
<td>it44</td>
<td>1.39</td>
<td>0.81</td>
</tr>
</tbody>
</table>

Table 11  
Descriptive Statistics of the Items in Group A-BS_AR (N=166)  

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>it_A5</td>
<td>1.35</td>
<td>0.90</td>
</tr>
<tr>
<td>it_A9</td>
<td>1.33</td>
<td>0.86</td>
</tr>
<tr>
<td>it_A14</td>
<td>1.36</td>
<td>0.88</td>
</tr>
<tr>
<td>it_A22</td>
<td>1.48</td>
<td>1.00</td>
</tr>
<tr>
<td>it_A31</td>
<td>1.46</td>
<td>0.97</td>
</tr>
<tr>
<td>it_A36</td>
<td>1.74</td>
<td>1.21</td>
</tr>
<tr>
<td>it_A39</td>
<td>2.25</td>
<td>1.58</td>
</tr>
<tr>
<td>it_A44</td>
<td>1.53</td>
<td>1.03</td>
</tr>
</tbody>
</table>

Table 12  
Descriptive Statistics of the Items in Group A-BS_EN (N=166)  

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>it_E5</td>
<td>1.51</td>
<td>1.08</td>
</tr>
<tr>
<td>it_E9</td>
<td>1.62</td>
<td>1.13</td>
</tr>
<tr>
<td>it_E14</td>
<td>1.62</td>
<td>1.22</td>
</tr>
<tr>
<td>it_E22</td>
<td>1.63</td>
<td>1.08</td>
</tr>
<tr>
<td>it_E31</td>
<td>1.72</td>
<td>1.16</td>
</tr>
<tr>
<td>it_E36</td>
<td>2.00</td>
<td>1.38</td>
</tr>
<tr>
<td>it_E39</td>
<td>2.47</td>
<td>1.44</td>
</tr>
<tr>
<td>it_E44</td>
<td>1.86</td>
<td>1.19</td>
</tr>
</tbody>
</table>
Table 13
Descriptive Statistics of the Language Proficiency Items (N=116)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAS17</td>
<td>1.28</td>
<td>0.72</td>
</tr>
<tr>
<td>BAS18</td>
<td>1.22</td>
<td>0.61</td>
</tr>
<tr>
<td>BAS19</td>
<td>2.97</td>
<td>0.91</td>
</tr>
<tr>
<td>BAS20</td>
<td>2.46</td>
<td>0.95</td>
</tr>
<tr>
<td>BAS21</td>
<td>2.52</td>
<td>1.11</td>
</tr>
<tr>
<td>BAS22</td>
<td>2.43</td>
<td>1.00</td>
</tr>
<tr>
<td>BAS23</td>
<td>2.26</td>
<td>1.05</td>
</tr>
</tbody>
</table>

CFA Model Identification

The Congeneric Model for GMD model is shown in Figure 4 consists of 16 freely estimated parameters (8 factor loadings and 8 items errors). However, the number of known variances of parameter and covariances in the input matrix exceeds the number of freely estimated parameters. Therefore, the one factor model in this analysis is known as “overidentified” (Brown, 2006, P. 67). Specifically, in the measurement model there are 36 pieces of information in the input matrix. The input matrix was calculated based on the formula suggested by Brown (2006), \( b = \frac{p(p+1)}{2} \) where \( b \) is the number of elements in the input matrix and \( p \) is the number of indicators. The model involves 8 variances and 28 covariances \( \frac{p(p-1)}{2} \). Since the model entails 16 freely estimated parameters, it is an overidentified model with degrees of freedoms equal 20 (36 known parameters minus 16 unknown parameters).
Figure 4. Congeneric Measurement Model for GMD of BPCS, Number in Boxes are Actual Item Question Numbers

Answering the Research Questions

Tests of factorial invariance represent a series of nested model comparisons, as presented in Chapter III. Thus results related to research questions 1 and 2 are presented together for the five pairwise groups:

1- Factorial invariance between A-NES and A-NAS
2- Factorial invariance between Ar-BS_AR and Ar-BS_EN
3- Factorial invariance between A-NAS and Ar-BS_AR
4- Factorial invariance between A-NAS and Ar-BS_EN
Factorial Invariance: A-NES and A-NAS

Table 14 and 15 present the covariance matrices for the MGCFA of measurement invariance for A-NAS and A-NES.

Table 14
Correlation Matrix (with variances on the diagonal) Group A-NES

<table>
<thead>
<tr>
<th></th>
<th>It5</th>
<th>It9</th>
<th>It14</th>
<th>It22</th>
<th>It31</th>
<th>It36</th>
<th>It39</th>
<th>It44</th>
</tr>
</thead>
<tbody>
<tr>
<td>It5</td>
<td></td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It9</td>
<td>0.90</td>
<td></td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It14</td>
<td>0.91</td>
<td>0.91</td>
<td></td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It22</td>
<td>0.92</td>
<td>0.91</td>
<td>0.93</td>
<td></td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>It31</td>
<td>0.90</td>
<td>0.91</td>
<td>0.93</td>
<td>0.94</td>
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<td>0.96</td>
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<tr>
<td>It36</td>
<td>0.83</td>
<td>0.86</td>
<td>0.88</td>
<td>0.88</td>
<td>0.89</td>
<td></td>
<td>0.89</td>
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</tr>
<tr>
<td>It39</td>
<td>0.81</td>
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<td>0.85</td>
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<td>0.87</td>
<td>0.86</td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>It44</td>
<td>0.81</td>
<td>0.85</td>
<td>0.85</td>
<td>0.88</td>
<td>0.87</td>
<td>0.86</td>
<td>0.79</td>
<td></td>
</tr>
</tbody>
</table>

Table 15
Correlation Matrix (with variances on the diagonal) Group A-NAS

<table>
<thead>
<tr>
<th></th>
<th>It5</th>
<th>It9</th>
<th>It14</th>
<th>It22</th>
<th>It31</th>
<th>It36</th>
<th>It39</th>
<th>It44</th>
</tr>
</thead>
<tbody>
<tr>
<td>It5</td>
<td></td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It9</td>
<td>0.54</td>
<td></td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It14</td>
<td>0.50</td>
<td>0.49</td>
<td></td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It22</td>
<td>0.47</td>
<td>0.45</td>
<td>0.49</td>
<td></td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It31</td>
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<td>0.42</td>
<td>0.44</td>
<td>0.38</td>
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<td>0.45</td>
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<td></td>
</tr>
<tr>
<td>It36</td>
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<td>0.24</td>
<td>0.26</td>
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</tr>
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<td>0.53</td>
<td>0.48</td>
<td>0.64</td>
<td></td>
<td>0.55</td>
</tr>
</tbody>
</table>

Table 16 presents MGCAFA Summary findings for measurement invariance for A-NES and A-NAS. As can be seen from this table the equal form model fit $\chi^2 (55) = 139.20, p<0.001$ was rejected. Although CFI and TLI indices are all acceptable, note
that RMSEA = 0.08 for the equal form is considerably smaller than the RMSA= 0.11 of A-NAS single group model. Specific parameter estimate are in Table A1 in Appendix A.

The next step in evaluating measurement invariance tests for equal factor loadings between A-NES and A-NAS samples. The test of the equal factor loadings (see Appendix D for the Mplus Input script) was evaluated by Chi-square Difference Test suggested by Muthen & Muthen (2009). The test for equal factor loading was not rejected \( p = 0.06 \). Table 16 shows that the equal factor loading model fit the data well CFI=1.0, and TLI=1.0. Supporting the conclusion that the otem-latent variable loadings were statistically equivalent between the groups, it can be concluded that the indicators evidence a level of weak factorial invariance across A-NAS and A-NAS groups in the latent construct GMD.

Since weak factorial invariance was supported, examination of the intercepts is wanted and a test for equal intercept model (Mplus script in Appendix D) was conducted. Table 16 shows a fit of \( \chi^2 (70) = 648.71, p<0.001 \) and a significant \( \chi^2 \text{ diff} (7) =340.72, p<0.05 \) rejecting the hypothesis of strong factorial invariance. Due to the lack of strong factorial invariance between A-NES and A-NAS, any comparison of the groups on latent mean of GMD is not interpretable. Partial invariance was examined in several models in an attempt to isolate specific items that may not be invariant, but all models failed to adequately improve the overall result. See Table 16.

Since evidence for only weak factorial invariance was found for A-NES and A-NAS there was no justification for examination of structural invariance between these two groups. Thus for Research Question one, weak measurement invariance exists and
Table 16

Test of Measurement Invariance between A-NES & A-NAS

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$\chi^2_{\text{diff}}$</th>
<th>$\Delta df$</th>
<th>P-Value</th>
<th>RMSEA</th>
<th>CFI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-NES</td>
<td>200</td>
<td>34.28</td>
<td>20</td>
<td></td>
<td>0.02</td>
<td>0.06</td>
<td>1.00</td>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>A-NAS</td>
<td>320</td>
<td>98.10</td>
<td>20</td>
<td></td>
<td>0.00</td>
<td>0.11</td>
<td>0.89</td>
<td>0.85</td>
<td></td>
</tr>
</tbody>
</table>

**Measurement Invariance**

- **Equal form**: 139.20, df=55, $\chi^2_{\text{diff}}$, <0.001, RMSEA=0.08, CFI=1.00, TLI=1.00
- **Equal factor loadings**: 150, df=62, $\chi^2_{\text{diff}}$=13.49, df=7, $\chi^2$=0.06, RMSEA=0.07, CFI=1.00, TLI=1.00
- **Equal Intercepts**: 236.14, df=70, $\chi^2_{\text{diff}}$=89.38, df=8, $\chi^2$=<0.001, RMSEA=0.17, CFI=1.00, TLI=1.00

For Research Question two no structural invariance exists between A-NES and AN-NAS. MIMIC modeling for Research Question three was not be performed since these two groups were administered single forms of the instruments.

**Factorial Invariance: Ar-BS_EN and Ar-BS_AR**

Tables 17 and 18 present the covariance matrices for the MGCFA of measurement invariance for Ar-BS_EN and Ar-BS_AR.

Table 19 presents a non significant finding for equal form $\chi^2 (55) = 69.14$, $p=0.10$ indicating that configural factorial invariance exists. The CFI a TLI and RMSEA indices are all acceptable. Specific parameter estimate are presented in Table A2 in Appendix A. Next the rest of equal factor loadings was conducted. This non significant
Table 17
Correlation Matrix (with variances on the diagonal) Group Ar-BS_EN

<table>
<thead>
<tr>
<th></th>
<th>It5</th>
<th>It9</th>
<th>It14</th>
<th>It22</th>
<th>It31</th>
<th>It36</th>
<th>It39</th>
<th>It44</th>
</tr>
</thead>
<tbody>
<tr>
<td>It5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It9</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It14</td>
<td>0.84</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It22</td>
<td>0.75</td>
<td>0.79</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It31</td>
<td>0.70</td>
<td>0.62</td>
<td>0.69</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It36</td>
<td>0.64</td>
<td>0.69</td>
<td>0.58</td>
<td>0.62</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It39</td>
<td>0.53</td>
<td>0.63</td>
<td>0.56</td>
<td>0.56</td>
<td>0.49</td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It44</td>
<td>0.58</td>
<td>0.79</td>
<td>0.67</td>
<td>0.76</td>
<td>0.61</td>
<td>0.59</td>
<td>0.67</td>
<td></td>
</tr>
</tbody>
</table>

Table 18
Correlation Matrix (with variances on the diagonal) Group Ar-BS_AR

<table>
<thead>
<tr>
<th></th>
<th>It5</th>
<th>It9</th>
<th>It14</th>
<th>It22</th>
<th>It31</th>
<th>It36</th>
<th>It39</th>
<th>It44</th>
</tr>
</thead>
<tbody>
<tr>
<td>It5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It9</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It14</td>
<td>0.92</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It22</td>
<td>0.85</td>
<td>0.89</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It31</td>
<td>0.81</td>
<td>0.92</td>
<td>0.86</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It36</td>
<td>0.71</td>
<td>0.76</td>
<td>0.73</td>
<td>0.71</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It39</td>
<td>0.59</td>
<td>0.59</td>
<td>0.46</td>
<td>0.51</td>
<td>0.52</td>
<td>0.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It44</td>
<td>0.86</td>
<td>0.86</td>
<td>0.89</td>
<td>0.77</td>
<td>0.78</td>
<td>0.66</td>
<td>0.51</td>
<td></td>
</tr>
</tbody>
</table>

result indicates that weak factorial invariance exists and all model fit statistics are reasonable. The equal intercepts model also showed a non significant $\chi^2_{diff}(8) = 8.27, p = 0.41$ indicating that strong factorial invariance exist.

In this test, factor loadings were held to equality and the Ar-BS_EN group was held as a reference group by fixing its latent mean to zero. The intercepts of the indicators were invariant between the Ar-BS_AR and Ar-BS_EN groups. The unstandardized parameter estimate for the latent mean of GMD in Ar-BS_AR was 1.11,
indicating that on average, Ar-BS_AR scores 1.11 above the average of Ar-BS_EN on the GMD.

Existence of measurement invariance allows testing for structural invariance, see Mplus scripts in Appendix D. The tests of equal variance and equal latent means were also not rejected $p=0.18$ and $p=0.19$ respectively, see Table 19. This indicates that the structural invariance exists.

Table 19
Test of Measurement Invariance between Ar-BS_AR & Ar-BS_EN

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$\chi^2_{diff}$</th>
<th>$\Delta df$</th>
<th>P-Value</th>
<th>RMSEA</th>
<th>CFI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ar-BS_AR</td>
<td>116</td>
<td>35.98</td>
<td>20</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td>0.08</td>
<td>1.00</td>
<td>0.99</td>
</tr>
<tr>
<td>Ar-BS_EN</td>
<td>116</td>
<td>20.20</td>
<td>20</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td>0.01</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Measurement Invariance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal form</td>
<td>69.14</td>
<td>55</td>
<td></td>
<td>0.10</td>
<td></td>
<td>0.05</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Equal factor loadings</td>
<td>69.55</td>
<td>62</td>
<td>7</td>
<td>0.69</td>
<td></td>
<td>0.03</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Equal Intercepts (threshold)</td>
<td>77.24</td>
<td>70</td>
<td>8</td>
<td>0.41</td>
<td></td>
<td>0.03</td>
<td>1.99</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td><strong>Test of Heterogeneity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal Variance</td>
<td>74.99</td>
<td>71</td>
<td>1.83</td>
<td>1</td>
<td>0.18</td>
<td>0.02</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Equal Latent Mean</td>
<td>80.42</td>
<td>72</td>
<td>3.36</td>
<td>2</td>
<td>0.19</td>
<td>0.03</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

Thus for research question one strong measurement invariance was found for the Ar-BS_AR and Ar-BS_EN. For research question two structural invariance exists in
these data. Therefore, there was no justification for investigation MIMIC model for research question three.

Factorial Invariance: A-NAS and Ar-BS_AR

As shown in Table 20, the equal form model shows a model fit $\chi^2 (55) = 158.61, p<0.001$ was rejected. The parameter estimates for each group are presented in Table A3 in Appendix A. Model modification indices CFI and TLI are acceptable, the RMSEA =0.10 is not acceptable. Although there is only weak model to data fit, tests for measurement invariance were continued. The model showed a non significant equal loading model $p=0.33$, indicating that weak factorial invariance exists between these two groups. However, the equal intercepts model showed a significant chi square $\chi^2_{\text{diff}} (7) =12.57, p<0.05$. Therefore, the hypothesis of equal intercepts was rejected. Partial invariance was examined in several models in an attempt to isolate specific items that may not be invariant but all models failed to adequately improve the overall result, see Table 22. Since evidence for only weak factorial invariance was found for A-NAS and Ar-BS_AR there was no justification for structural invariance between these two groups. Thus for research question one, weak measurement invariance exists and for research question two no structural invariance exists in these data. Although the Ar-BS_AR administered the BAS instrument the MIMIC modeling for research question still could not be performed due to the absence of strong measurement invariance.
Table 20
Test of Measurement Invariance between A-NAS & Ar-BS_AR

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$\chi^2_{diff}$</th>
<th>$\Delta df$</th>
<th>P-Value</th>
<th>RMSEA</th>
<th>CFI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-NAS</td>
<td>320</td>
<td>98.99</td>
<td>20</td>
<td>&lt;0.001</td>
<td>0.11</td>
<td>0.89</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ar-BS_AR</td>
<td>116</td>
<td>35.98</td>
<td>20</td>
<td>&lt;0.001</td>
<td>0.08</td>
<td>0.89</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Measurement Invariance

| Equal form | 158.61 | 55 | <0.001 | 0.10 | 0.95 | 0.95 |
| Equal factor loadings | 150.91 | 62 | 8.02 | 7 | 0.24 | 0.08 | 0.96 | 0.96 |
| Equal Intercepts | 189.41 | 70 | 45.02 | 8 | <0.001 | 0.08 | 0.95 | 0.96 |
| Partial Invariance | 188.54 | 69 | 42.76 | 7 | <0.001 | 0.09 | 0.94 | 0.95 |

Factorial Invariance: A-NAS and Ar-BS_EN

Table 21 shows a significant equal form model fit $\chi^2 (55) = 143.57$, $p<0.001$ was rejected. However, the model data fit was reasonable CFI and TLI are all in the acceptable range except for RMSEA which was at the high end of acceptability. Specific parameter estimate are presented in Table A4 in Appendix A. The result of the equal factor loadings test was not rejected $p=0.42$ indicating weak invariance existed between these two groups. The equal intercepts model also showed a non significant fit $\chi^2_{diff} (8) =0.270$ indicating evidence of strong factorial invariance. The strong measurement invariance allows continuing with testing for structural invariance. Significant results for tests of equal variance and equal latent means were found indicating that the hypothesis
of structural invariance was rejected. When the latent mean of the A-NAS was held to equal zero, the unstandardized parameter estimate for the latent mean of the Ar-NBS_EN is equal to -0.22. This indicates that on average A-BS_EN scores 0.22 below the average of A-NAS on the GMD indicators. Since structure invariance was not supported, examination of covariate is legitimate and MIMIC modeling was conducted. Table 24 shows a non significant fit \( p = 9.89 \) indicating that the acculturation scale failed to mediate the level of invariance across these groups. See Figure 5 for the one-factor CFA-MIMIC model.

Table 21
Test of Measurement Invariance between A-NAS & Ar-BS_EN

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>( \chi^2 )</th>
<th>df</th>
<th>( \chi^2 _\text{diff} )</th>
<th>( \Delta _\text{df} )</th>
<th>P-Value</th>
<th>RMSEA</th>
<th>CFI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-NAS</td>
<td>320</td>
<td>98.99</td>
<td>20</td>
<td>&lt;0.001</td>
<td>0.11</td>
<td>0.89</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ar-BS_EN</td>
<td>116</td>
<td>20.20</td>
<td>20</td>
<td>&lt;0.001</td>
<td>0.01</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Measurement Invariance

<table>
<thead>
<tr>
<th></th>
<th>( \chi^2 )</th>
<th>df</th>
<th>( \chi^2 _\text{diff} )</th>
<th>( \Delta _\text{df} )</th>
<th>P-Value</th>
<th>RMSEA</th>
<th>CFI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal form</td>
<td>143.57</td>
<td>55</td>
<td>&lt;0.001</td>
<td>0.09</td>
<td>0.98</td>
<td>0.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal factor loadings</td>
<td>137.05</td>
<td>62</td>
<td>7.10</td>
<td>7</td>
<td>0.420</td>
<td>0.08</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>Equal Intercepts</td>
<td>143.88</td>
<td>70</td>
<td>9.92</td>
<td>8</td>
<td>0.27</td>
<td>0.07</td>
<td>0.98</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Test of Heterogeneity

<table>
<thead>
<tr>
<th></th>
<th>( \chi^2 )</th>
<th>df</th>
<th>( \chi^2 _\text{diff} )</th>
<th>( \Delta _\text{df} )</th>
<th>P-Value</th>
<th>RMSEA</th>
<th>CFI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal Variance</td>
<td>167.72</td>
<td>71</td>
<td>10.37</td>
<td>1</td>
<td>&lt;0.05</td>
<td>0.08</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td>Equal Latent Mean</td>
<td>144.10</td>
<td>72</td>
<td>11.31</td>
<td>2</td>
<td>&lt;0.05</td>
<td>0.07</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>MIMIC Model</td>
<td>766.98</td>
<td>88</td>
<td>9.89</td>
<td>1</td>
<td>&lt;0.05</td>
<td>0.19</td>
<td>0.86</td>
<td>0.88</td>
</tr>
</tbody>
</table>
Figure 5. One Factor CFA MIMIC Model for A-NAS and Ar-BS_EN

For research question one, the A-NAS and Ar-BS_AR evidenced strong factorial invariance. However, for question two the structural invariance was not observed in the data. For research question three, the MIMIC model failed to mediate the structural variance found between these groups.

Summary of the Findings

Table 22 shows the distribution of the three research question results among the study groups. The measurement invariance tests between the A-NES and A-NAS showed a weak factorial invariance. Structural invariance and MIMIC modeling tests were not applicable. However, the measurement invariance tests between the Ar-BS_EN and Ar-BS_AR showed strong factorial invariance and structural invariance. Again the MIMC model was not applicable for these groups. The measurement invariance tests between A-
NAS and A-BS_AR showed a weak factorial invariance existed and thus Structural invariance and MIMIC modeling tests were not applicable. Lastly, the measurement invariance between the A-NAS and Ar-BS_EN showed a strong factorial invariance. However, the structural invariance did not exist and the MIMIC model failed to mediate the level of variance between the groups indicates that the groups are strongly invariant. Figure 6 below summarizes the results of the factorial invariance tests between the groups under study.

Figure 6. Summarized Results of Factorial Invariance Tests
### Table 22

The Distribution of the Three Research Questions among the Study Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>RQ1 Measurement Invariance</th>
<th>RQ2 Structural Invariance</th>
<th>RQ3 Acculturation/MI MIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-NES &amp; A-NAS</td>
<td>Weak Factorial Invariance</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Ar-BS_AR &amp; Ar-BS_EN</td>
<td>Strong Factorial Invariance</td>
<td>Exists</td>
<td>N/A</td>
</tr>
<tr>
<td>A-NAS &amp; Ar-BS_AR</td>
<td>Weak Factorial Invariance</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>A-NAS &amp; Ar-BS_EN</td>
<td>Strong Factorial Invariance</td>
<td>Does not exits</td>
<td>Fail</td>
</tr>
</tbody>
</table>
CHAPTER V

DISCUSSION

This chapter presents a conclusion of the study, discussion, the limitations, and recommendations for future research.

Conclusion

In this study, the questions investigated were:

1. To what level does measurement invariance exist between an original and translated instrument among mono- and bilingual samples?

2. If measurement invariance exists, does invariance extent to structural invariance among the mono- and bilingual samples?

3. If measurement or structural invariance does not exist, does the respondent’s level of acculturation mediate the level of invariance?

Data were collected on the BPCS from participants representing different language/cultural groups: American native English speakers (A-NES), Arab native Arabic speakers (A-NAS), and Arab bilingual who responded once to the English version of the instrument (Ar-BS_EN) then to the Arabic version (Ar-BS_AR). Also, bilingual participants responded to the BAS acculturation instrument. Although the full BPCS and BAS instrument were collected, only GMD factor of the BPCS, and the language
proficiency factor of the BAS were included in the analysis. Measurement invariance across translated forms of the BPCS was examined in the following MGCFA analyzes: A-NES vs. A-NAS which examined invariance in translated forms in two monolinguistic samples; A-NAS vs. Ar-BS_EN which examines measurement invariance between translated forms (English vs. Arabic) between mono- and bilingual groups; A-NAS vs. Ar-BS_AR which examines measurement invariance in a translated form (Arabic) between mono- and bilingual groups; and Ar-BS_EN vs. Ar-BS_AR which examine measurement invariance between translated forms (English vs. Arabic) within two bilingual groups. Tests of structural invariance were also investigated between (A-NAS and Ar-BS_AR) and (Ar-BS_EN and. Ar-BS_AR) groups if warranted following the confirmation of strong measurement invariance. Finally, in the bilingual groups, acculturation was investigated as a possible mediating factor to measurement or structural invariance in a MGCFA/MIMIC model.

The result revealed weak measurement invariance between: A-NES and A-NAS indicating equivalence in the factor loadings between the two groups. The test for strong measurement invariance was rejected (equal indicator intercepts) meaning that the total mean score on the underlying construct GMD is not similar between the groups. Based on the assumption that the groups are similar in their characters such as level of education, age, etc., this indicates that there is evidence of cultural/language differences embedded in translation.

A comparison of the Arab native group (A-NAS) to the Ar-BS_EN, (bilingual Arab responding to the original English version of the BPCS) supported the conclusion of strong measurement invariance. However, only weak measurement invariance was
established between the A-NAS and Ar-BS_AR groups, (Arab bilingual responding to the Arabic form of the BPCS). Due to the presence of strong measurement invariance between A-NAS and Ar-BS_EN, a comparison of the unstandardized latent means is meaningful. The latent mean of the Arab native group was 0.22 units higher the latent mean of the Ar-BS_EN group. The Arab native group’s latent mean was 0.84 higher than the Ar-BS_AR group’s latent mean.

When the responses of the bilingual participants on the Arabic and English versions were compared (Ar-BS_EN and Ar-BS_AR) strong factorial invariance was supported. The unstandardized latent mean score of the Ar-BS_AR group was 1.11 higher than the Ar-BS_EN latent mean score supporting the conclusion that when the bilingual participants respond to the BPCS in their native language, they evidenced higher latent mean scores.

In group comparisons evidencing strong measurement invariance, population heterogeneity or structural invariance was examined. Structural invariance was found between the bilingual when they responded to the Arabic and English forms of the instrument (Ar-BS_EN and Ar-BS_AR) but not between the A-NAS and the Ar-BS_EN. To examine if the level of acculturation may mediate the presence of structural invariance between A-NAS and the Ar-BS_EN the average score of the bilingual participants on the language proficiency factor of the acculturation instrument was used as a covariate in a MGCFA/MIMIC model. Results showed that the level of acculturation as measured by the BAS did not mediate the level of structural invariance between A-NAS and the Ar-BS_EN groups suggesting that the difference in latent means between these groups is likely due to culture and translation.
In conclusion, the results of this study indicated the presence of language/cultural differences across translated forms of the BPCS even following “best practice translation,” e.g., blind back translation. Although the A-NAS and Ar-BS_EN showed strong measurement invariance, these groups failed to show structural invariance. Furthermore, the A-NAS and Ar-BS_AR groups showed only weak factorial invariance indicating differences between native speakers and bilingual participants across translated forms. However, all of the comparisons of the bilingual groups showed higher levels of invariance than the monolingual comparisons. This suggests that bilingual people are able to cross translate the translated instruments, they “borrow” knowledge from one language to other, perhaps filling in where translation may be weak. Lastly, this study failed to identify any mediating effects of acculturation in bilingual speakers.

Discussion

This study examined the adequacy of blind back translation for the BPCS to construct equivalent measurement instruments. Mono- and bilingual samples were administered appropriate language versions of the BPCS to determine if there are specific cultural elements within a translation that failed translation. If so, could a respondent’s level of acculturation be used as a mediating factor for the translation? Given that this study involved three different language groups (native English, native Arabic and bilingual English/Arabic) taking two forms of the BPCS (Original English and translated Arabic) the use of MGCFA was a natural strategy to answer the research questions posed in Chapter I (Millsap & Tein, (2004); Brown, (2006); Cheung & Rensvold, (1999).
Study findings supported previous research (Rettig & Pasamanick, 1962) which investigated measurement invariance between American and Korean students, on moral judgment scale. Results showed invariance among some factors but not all factors which the authors argued may have resulted from the translation changing the meaning of some items. Although that study aimed to distinguish American and Korean students in their moral judgment this comparison could have been invalidated due to translation. Current findings are also consistent with Milewski, et., al’s (2000) study which investigated measurement invariance of the Advanced Placement International English Language exam (APIEL) between Chinese and German students. These authors found that the factor loadings were not invariant between the groups, (a failure of weak measurement invariance). They suggested further study is needed, especially involving examinees from different languages. The current study represents an expansion on the work of Milewskie, et al. by examining translation in mono- and bilingual groups. Specifically, in monolingual/monocultural comparison using translated forms only weak measurement invariance could be established. This is contrasted by the fact that only strong measurement invariance was established in a monocultural/bilingual comparison using translated forms. This provides some evidence that there are culturally distinct elements within translated forms of the BPCS.

This finding illustrates just how difficult translation is, due to the intertwined nature of language and culture reviewed in Chapters I and II. The results of this study supports Martin and Nakayama (1999) claim that “language restricts the thoughts of people who use it…” (p.152). In this study, the lack of measurement invariance between the American native speakers and the Arabs native speakers is a typical illustration of the
argument of Martin and Nakayama (1999). The linguists Thriveni (2002), Adewuni (2008), and Karamanian (2002) also agree with Martin and Nakayama (1999) when they argued that language influences peoples’ thinking, therefore people think culturally. The presence of only weak invariance between the Arab native speakers and Arab bilingual speakers when they responded to the English form of the BPCS is strong evidence that people’s thoughts are different when they respond in their native language relative to a translated language (Marlowe, 2004).

Understanding the findings and conclusions of this study from the perspectives of the social/cultural theories previously reviewed in Chapter II is warranted. The constructivist Boroditsky (2009) said that language shapes the way we think. According to the Marxist Spirkin (1983), thought is a mental activity in any language. However, postpositivists advocated that thoughts and behavior are determined or partially influenced by language (Kay & Kempton, 1984). According to the three social theories, converting meaning from one language to another – cultural translation – is complicated (Thriveni, 2002) but nevertheless critically important whenever there is intent to infer meaning from a measuring instrument cross-culturally. The problems encountered in cultural translation makes the Marxist Spirkin (1983) doubt that translation actually helps people to understand each other. Differences in cultures, histories, social structures, beliefs, feelings, and traditions lie behind translation complexity and translation requires building cognitive path from one language/culture to another. For example, when Spirkin (1983) stated that translating the ancient Indian writings into Russian cannot help understanding the ancient Indians, he was indicating that translation cannot convey all meaning embed in the original documents. In terms of social structure, Thriveni
(2002) said that with an Indian culture, people show respect to their elders by addressing them in plural. This is similar to the case of African societies when they call elders “old man” or “old woman” as a term of respect. However, this might be inappropriate in western cultures such as the French culture. Beliefs and feelings are also different from one culture to another. Again for someone with an Islamic background, an olive tree is automatically associated with the holy Quran, the foundation of the religion. The dish *Burbara* is a well-known meal among Arab Christians in Lebanon, Syria and Palestine. This dish reminds these communities of the “Eid il-Burbara” or “Saint Barabara's” Day. This meal might have no meaning for the Christians in western cultures. To summarize, it is clear that language affects peoples’ thoughts and people think culturally which can be used to explain Milewski et al.’s. (2000) statement that it is difficult to find invariance between different cultures as was further illustrated in this study. However, strong measurement invariance was found within bilingual participants when they responded to both the Arabic and English forms. While this finding may be influenced by the minimal two-week interval between assessments, form language was randomized to minimize this influence.

Surprisingly when the BAS was added as a mediating factor in a MGCFA/MIMIC model to examine if acculturation affects the level of invariance seen between Arab native speakers and the Arab bilingual speakers, results showed there is no effect. This result may be because the bilingual participants were all Arab, adult and foreign students decreasing the possibility that this group is really experiencing acculturation.
Al-Ma’seb (2006) discussed the factors that influence the acculturation process. She said that the longer the period of the emigrants in the host culture, the more likely that the emigrant is affected by the culture of the host country. The majority of the populations were undergraduate students who have been in the USA for only a short period of time. In addition, it was noticed that while collecting the data, the Arab students were clustering together, and not socializing with other American students. Al-Ma’seb (2006) mentioned that contact affects the level of acculturation. This illustrates that the Arab bilingual sample used in this study were less likely to show variability on this construct. Another factor that may affect the level of acculturation is age. Previous research has shown that immigration (to the US) at a younger age is associated with higher levels of acculturated to the American culture (Franco, et al., 1998). Given the sample demographics of the Arab bilingual group used in this study one would expect low levels of acculturation which probably negatively influenced the impact of this construct in the MGCFA/MIMIC analysis.

Limitations of the Study

There were a number of limitations to this study. One of the limitations of the study was that the dialect was not considered in this study. Dialect, defined by Wolfram & Schilling (2006) is the language that is shared by a group of people. Since this study recruited samples from different regions, the dialect of the populations could be different. However, due to the numbers and length of the instruments used, dialect was not considered in the study.
The study was also limited to three different cultural groups instead of four as was originally planned. Unfortunately, a sufficient number of US individuals who are Arabic bilingual were not obtained precluding this group from any analysis.

Another limitation is that the Arabic/English bilingual population was limited to the university level students. The problem was that these participants were not able to have enough time to show the acculturation level. Or, they may have showed some hesitation on their part to disclose their true level of acculturation due to their beliefs and strong sense of cultural identity. A last limitation of this study is that the BAS was translated and this could have been the focus of this study, instead it was assumed that the structural invariance exists. This clearly may not be true.

The ideal sample size initially computed for this study was impossible to reach considering the time constraint. Therefore, an alternative sample size was used. Although this sample size was sufficient given the ordinal data, within group sample sizes were minimal at best. Another study with the initially computed sample size might have produced different result.

Recommendations for Future Research

There are several studies that were conducted to study the validity of translated instruments in cross cultural studies. However, there are still many areas that need to be examined. Recommendations raised from this present study include replication of this current study with a larger sample, especially a larger population of the Arabic bilinguals. Furthermore, inclusion of the US/Arabic bilingual group to complete the pairwise
examination of translation invariance is recommended. For example, those studies may
consider the recruitment of Arabic bilinguals who have spent a considerable amount of
time spent in the American society. This may include individuals owning businesses or
individuals working in a business in the USA. Since there are other measures of
accommodation e.g., accommodation measures developed in the USA, which may present
better measures of accommodation, this study might be replicated using other measures of
accommodation. Moreover, the assumption that strict measurement invariance exists across
translation within the accommodation measure should itself be investigated.

This study is a great application of factorial invariance as measurement model. However it provides fundamental knowledge required for structural equation modeling (SEM). A recommendation for other researchers who have interest in domain will be to use this study as guidance while conducting a higher order of factorial invariance analysis. Moreover this study evidences that translation might affect the underlying meaning of a psychological construct. Therefore, it is recommended that researchers who conduct intercultural studies must carefully choose their research instruments by examining the validity of those instruments if there are not primarily intended to the population target of their study.
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Barber, C. E., Cook, A. S., & Ackerman, A. (1985). The Influence of Acculturation on
Attitudes of Filial Responsibility among Navajo Youth. *American Indian
Quarterly, 9*(4), 421-432.

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Interscience

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117


122


Appendix A

Tables
Table A1

Parameter Estimates from the Equal Form Measurement Model of GMD in A-NES and A-NAS

<table>
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<tr>
<th>Items: A-NES</th>
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<th>Est/S.E</th>
<th>Residual Variances</th>
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<th>S.E</th>
<th>Est/S.E</th>
<th>Residual Variances</th>
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Note: First item was fixed to 1 as marker indicator.
### Table A2
Parameter Estimates from the Equal Form Measurement Model of GMD in Ar-BS_EN and Ar-BS_AR

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Parameter Estimates from the Equal Form Measurement Model of GMD in A-NAS and A-BS_AR

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Table A5
Raw Information of the Sample Demographics

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<td>Post Bachelor</td>
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<td>Doctorate</td>
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<td><strong>Time Spent Outside Native country (in month)</strong></td>
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<td><strong>AGE</strong></td>
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Appendix B

Figures
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Figure B. Frequency Histogram for Scores
Figure B. Frequency Histogram for Scores (Continued)
Figure B. Frequency Histogram for Scores (Continued)
Appendix C

SAS Codes
Appendix C1: Illustrative Proc Import used to create a SAS database

*******************************************************************************;
* Dissertation Master Program                                            *
* Written by Fatma Ayyad                                                   *
* Created on 10/9/2009                                                      *
* Last edited 1/21/2010                                                    *
* libname out "C:\Documents and Settings\...\My Documents\Data\Dissertation"*
*   Reads Access DBs                                                      *
* C:\Documents and Settings\...\My Documents\Data\Dissertation\AccessDB\BPCS_G001ENG1.mdb
*******************************************************************************;
options nocenter;
PROC IMPORT OUT=Group1
   DATATABLE="Table1"
   DBMS=ACCESS REPLACE;
DATABASE="C:\Documents and Settings\...\My Documents\Data\Dissertation\AccessDB\BPCS_G001ENG1.mdb";
SCANMEMO=YES;
USEDATE=NO;
SCANTIME=YES;
RUN;
/*
proc contents data=out.group1;
run;
proc print data=out.group1;
run;
*/
data diss.diss_g1(drop=Croup_code Received_Date agree consent_date id sex);
   length default=3.;
   set group1;
   timeSpentOut= (year_arabic_country*12)+ month_arabic_country;
   Group="G001";
   subj=1000+id;
   GroupSub=Croup_code;
   nage=age;
   if age="" then nage=.;
   if sex="Female" then gender=0.;
   if sex="Male" then gender=1.;
   /*
   ******Belief in Personal Control Scale (converting alpha to numeric);
   array o1 (45) q1-q45;
   array n1 (45) it1-it45;
   do i=1 to 45;
   n1[i]=input(o1[i],4.);
   if o1[i]="" then n1[i]=.;
   end;
   array old q1-q45;
   array new it1-it45;
   do over old;
   new=old;
   if old="" then new=.;
   if gender=1 then sex=.;
   if gender=., then sex=0.;
   else sex=1.;
   end;
   run;
   proc sort data=diss.diss_g1;
   by subj;
   run;
   */
Appendix C2: Code Used to Create a Common Data Set

Dissertation Master Program
* Written by Fatma Ayyad
* Created on 10/9/2009
* Last edited 1/25/2010
* libname diss 'C:\Documents and Settings\...\My Documents\Data\Dissertation';
* Creates Master Dissertation data set
* 'C:\Documents and Settings\...\My Documents\Data\Dissertation\Allgroups'

*----------------------------------------------------------------------------------;
%include "C:\...\Dissertation\Group1 Setup.sas";
%include "C:\...\Dissertation\Group2 Setup.sas";
*%include "C:\...\Dissertation\Group3 Setup.sas";
%include "C:\...\Dissertation\Group4 Setup.sas";
data diss.Allgroups  
drop= i q1-q45 Lang1-Lang6 Pro1-Pro12 Med1-Med5);
  merge diss.diss_g1 diss.diss_g2 /*diss.diss_g3*/ diss.diss_g4;
  by subj;
*----------------------------------------------------------------------------------;

*                        Score Scales                        *
*----------------------------------------------------------------------------------;
*****BPCS;
***** fix reverse coded items
   array dummy (17) it1 it4 it7 it8 i10 it13 it17 it20 it23 it24 it27 it28 it29 it34 it35 it41 it42;
   do i=1 to 17;
      dummy{i} = 6 - dummy{i};
   end;
***** Score the 3 factors;
   GEC=sum(it2,it3,it6,it11,it12,it15,it16,it19,it21,it25,it26,it30,it32,it33,it37,it38,it40,it43,it45);
   ECD=sum(it1,it4,it7,it8,it10,it13,it17,it20,it23,it24,it27,it28,it29,it34,it35,it41,it42);
   GMD=sum(it5,it9,it14,it18,it22,it31,it36,it39,it44);
   label gec="General External Control"
         ecd="Exaggerated Control Dimension"
         gmd="God-mediated Dimension";

*****Acculturation;
***** fix reverse coded items;
   array acc bas4-bas6 bas13-bas18 bas22 bas23;
   do over acc;
      acc = 5 - acc;
   end;
   LUS=mean(of BAS1-BAS6);
   Profic=mean(of BAS7-BAS18);
   Media=mean(of BAS19-BAS23);
   label LUS="Language Use"
          Profic="Language Proficiency"
          media="Electronic Media";
*----------------------------------------------------------------------------------;

delete GROUP=3 due to low sample size;
if group="G003" then delete;
if group="G001" then E_IMPFLG=NMISS(of it1-it45);
if group="G002" then A_IMPFLG=NMISS(of it1-it45);
if group="G004" then E_IMPFLG=NMISS(of it_e1-it_e45);
if group="G004" then A_IMPFLG=NMISS(of it_a1-it_a45);
RUN;
*call imputation program;
%include "C:\Documents and Settings\...\My Documents\My SAS Files\Dissertation\impute.sas";
*call Make Mplus Data program;
%include "C:\Documents and Settings\...\My Documents\My SAS Files\Dissertation\ExportMplus.sas";
Appendix C3: Code used to output text for subsequent input Mplus software

Filename out1 "C:\Documents and Settings\...\My Documents\Data\Dissertation\group1.dat";
Filename out2 "C:\Documents and Settings\...\My Documents\Data\Dissertation\group2.dat";
Filename out3 "C:\Documents and Settings\...\My Documents\Data\Dissertation\group4e.dat";
Filename out4 "C:\Documents and Settings\...\My Documents\Data\Dissertation\group4a.dat";

Data Z;
Set diss.allImputed;
Profic_i=int((profic_i*100)+.5)/100;
   IF group="G001" then do;
      GP=1;
      File out1;
      Put Subj 1-4 gp 5 @6 (it1-it45) (1.);
   End;
   IF group="G002" then do;
      gp=2;
      File out2;
      Put Subj 1-4 gp 5 @6 (it1-it45) (1.);
   End;
   IF group="G004" then do;
      gp=4;
      File out3;
      Put Subj 1-4 gp @6 Profic_i 4.2 @10 (it_a1-it_a45) (1.);
      File out4;
      Put Subj 1-4 gp @6 Profic_i 4.2 @10 (it_e1-it_e45) (1.);
   End;
RUN;
Appendix C4: SAS Imputation Code

/****************************************************
IMPUTING ALL GROUPS DATA IN ONE DATABASE
****************************************************/

*Group 1;
PROC mi data=diss.allgroups round=1 min=1 max=5
  seed=1235343
  nimpute=1
  out=A1(keep=subj group it1-it45);
  mcmc initial=em;
  Var it1-it45;
  Where Group="G001";
RUN;
proc freq data=a1;
  tables it1-it45;
  run;
*Group 2;
PROC mi data=diss.allgroups round=1 min=1 max=5
  seed=47283343
  nimpute=1
  out=A2(keep=subj group it1-it45);
  mcmc initial=em;
  Var it1-it45;
  Where Group="G002";
RUN;
proc freq data=a2;
  tables it1-it45;
  run;
*Group 4 Arabic;
PROC mi data=diss.allgroups round=1 min=1 max=5
  seed=65453773
  nimpute=1
  out=A3(keep=subj group it_a1-it_a45);
  mcmc initial=em;
  Var it_a1-it_a45;
  Where Group="G004" and A_IMPFLG<5;
RUN;
proc freq data=a3;
  tables it_a1-it_a45;
  run;
*Group 4 English;
PROC mi data=diss.allgroups round=1 min=1 max=5
  seed=92353773
  nimpute=1
  out=A4(keep=subj group it_e1-it_e45);
  mcmc initial=em;
  Var it_e1-it_e45;
  Where Group="G004";
RUN;
proc freq data=a4;
    tables it_e1-it_e45;
    run;
*Group 5 Acculturation;
PROC mi data=diss.allgroups round=1 min=1 max=4
    seed=36243606
    nimpute=1
    out=A5(keep=subj group bas1-bas23);
    mcmc initial=em;
    Var bas1-bas23;
    Where Group="G004";
RUN;
proc freq data=a5;
    tables bas1-bas23;
    run;
data diss.AllImputed;
    merge diss.allgroups
        a1 a2 a3 a4 a5;
    by subj;
******************************************************************************
    Delete incomplete cases
******************************************************************************;
if subj=4075 or subj=4082 or subj=4083 or subj=4089 or subj=4109 or subj=4028
    or subj=4119 or subj=4012 or subj=4013 or subj=4028 or subj=4025 or subj>=4143 then delete;

*****BPCS;
    GEC_I=sum(it2,it3,it6,it11,it12,it15,it16,it19,it21,it25,it26,it30,it32,it33,it37,it38,it40,it43,it45);
    ECD_I=sum(it1,it4,it7,it8,it10,it13,it17,it20,it23,it24,it27,it28,it29,it34,it35,it41,it42);
    GMD_I=sum(it5,it9,it14,it18,it22,it31,it36,it39,it44);
    label gec_i="General External Control"
        ecd_i="Exaggerated Control Dimension"
        gmd_i="God-mediated Dimension";

*****Acculturation;
    LUS_I=mean(of BAS1-BAS6);
    Profic_I=mean(of BAS7-BAS18);
    Media_I=mean(of BAS19-BAS23);
    label LUS_I="Language Use"
        Profic_i=" Language Proficiency"
        media_i="Electronic Media";
    run;
******************************************************************************;
proc freq;
    tables group*(it1-it45)/list;
    where group="G001" or group="G002";
    run;
proc freq;
    tables it_a1-it_a45
        it_e1-it_e45
        bas1-bas23 LUS_I Profic_I;
    where group="G004";
    run;
Appendix D

Mplus Codes
TITLE: Initial Group 1 CFA: 1 factor model
DATA: FILE IS C:\Users\Fatma\Documents\Data\Dissertation\gp_1.dat;
   FORMAT IS F1.0,F3.0,1x,45F1.0,2x,F4.2;
VARIABLE: NAMES ARE group subj it1-it45 Profic_i;
   USEVARIABLES ARE it5 it9 it14 it22 it31 it36 it39 it44;
   MISSING ARE profic_i (9.00);
   CATEGORICAL ARE it5 it9 it14 it22 it31 it36 it39 it44;
ANALYSIS: ESTIMATOR=WLSMV;
   TYPE=General;
MODEL:
   GMD BY it5 it9 it14 it22 it31 it36 it39 it44;
OUTPUT: SAMPSTAT MODINDICES(0.0) RESIDUAL STANDARDIZED TECH2;
Appendix D2: MGCFA Test of Factor Invariance – Equal Form

TITLE:  MGCFA(gp1&gp2)Equal Form for GMD

DATA:    FILE IS C:\Users\Fatma\Documents\Data\Dissertation\gp_1_gp_2.dat;

FORMAT IS F1.0,F3.0,1x,45F1.0,2x,F4.2;

VARIABLE: NAMES ARE group subj it1-it45 Profic_i;
   USEVARIABLES ARE it5 it9 it14 it22 it31 it36 it39 it44;
   MISSING ARE profic_i (9.00);
   CATEGORICAL ARE it5 it9 it14 it22 it31 it36 it39 it44;
   GROUPING IS group (1=Gp1 2=Gp2);  !Specify Grouping factor

ANALYSIS: ESTIMATOR=WLSMV;
   Type=General;
   !DIFFTEST IS equalLOAD.dat;
   !Plot:   Type is PLOT1;

MODEL: GMD BY   it5 it9 it14 it22 it31 it36 it39 it44;

MODEL Gp2:  GMD BY it9 it14 it22 it31 it36 it39 it44; !free loadings;
   [it5$1-it44$1]; !free intercepts;
   !all indicator residual var/covar are free - Mplus default;

SAVEDATA:  DIFFTEST IS equalFORM.dat;
OUTPUT:  SAMPSTAT MODINDICES(ALL) STANDARDIZED RESIDUAL TECH4 TECH1;
Appendix D3: MGCFA Test of Factor Invariance – Equal Loadings

TITLE: MGCFA(gp1&gp2)Equal Factor Loadings for GMD

DATA: FILE IS C:\Users\Fatma\Documents\Data\Dissertation\gp_1_gp_2.dat;
      FORMAT IS F1.0,F3.0,1x,45F1.0,2x,F4.2;

VARIABLE: NAMES ARE group subj it1-it45 Profic_i;
       USEVARIABLES ARE it5 it9 it14 it22 it31 it36 it39 it44;
      MISSING ARE profic_i (9.00);
      CATEGORICAL ARE it5 it9 it14 it22 it31 it36 it39 it44;
      GROUPING IS group (1=Gp1 2=Gp2);  !Specify Grouping factor

ANALYSIS: ESTIMATOR=WLSMV;
      TYPE=GENERAL;
DIFFTEST IS equalFORM.dat

MODEL:     GMD BY it5 it9 it14 it22 it31 it36 it39 it44;
MODEL Gp2:  !sets all factor loading equal = EQUAL LOADINGS;
            [it5$1-it44$1]; !free intercepts;

SAVEDATA: DIFFTEST is equalLOAD.dat;

OUTPUT: SAMPSTAT MODINDICES(ALL) STAND RESIDUAL TECH1
        TECH4;
Appendix D4: MGCFA Test of Factor Invariance – Equal Intercepts

TITLE: Initial 2-Group gp_1_gp_2 CFA INTERCEPTS

DATA: FILE IS C:\Users\Fatma\Documents\Data\Dissertation\gp_1_gp_2.dat;
     FORMAT IS F1.0,F3.0,1x,45F1.0,2x,F4.2;

VARIABLE: NAMES ARE group subj it1-it45 Profic_i;
         USEVARIABLES ARE it5 it9 it14 it22 it31 it36 it39 it44;
         MISSING ARE profic_i (9.00);
         CATEGORICAL ARE it5 it9 it14 it22 it31 it36 it39 it44;
         GROUPING IS group (1=Gp1 2=Gp2);

ANALYSIS: ESTIMATOR=WLSMV;
         TYPE=General;
         PARAMETERIZATION = THETA;
         DIFFTEST IS equalLOAD.dat

MODEL:  GMD BY  it5 it9 it14 it22 it31 it36 it39 it44;
         !MODEL  Gp2:  !sets  = EQUAL LOADINGS;
         ![it5$1-it44$1]; !free intercepts;

SAVEDATA: DIFFTEST IS equalINT.dat

OUTPUT: SAMPSTAT MODINDICES (ALL) RESIDUAL STAND TECH1 TECH4;
Appendix D5: MGCFA Test of Factor Invariance – Partial Invariance

TITLE: Initial 2-Group gp_1_gp_2 CFA INTERCEPTS

DATA: FILE IS C:\Users\Fatma\Documents\Data\Dissertation\gp_1_gp_2.dat;
FORMAT IS F1.0,F3.0,1x,45F1.0,2x,F4.2;

VARIABLE: NAMES ARE group subj it1-it45 Profic_i;
USEVARIABLES ARE it5 it9 it14 it22 it31 it36 it39 it44;
MISSING ARE profic_i (9.00);
CATEGORICAL ARE it5 it9 it14 it22 it31 it36 it39 it44;
GROUPING IS group (1=Gp1 2=Gp2);

ANALYSIS: ESTIMATOR=WLSMV;
TYPE=General;
PARAMETERIZATION = THETA;
DIFFTEST IS equalLOAD.dat

MODEL: GMD BY it5 it9 it14 it22 it31 it36 it39 it44;
MODEL Gp2: [it5$1 it9$1 it31$1 it36$1]; !Partial Invariance;
![it5$1-it44$1]; !free intercepts;

SAVEDATA: DIFFTEST IS PartialINT.dat;
OUTPUT: SAMPSTAT MODINDICES(ALL) RESIDUAL STAND TECH1 TECH4;
Appendix D6: MGCFA Test of Structural Invariance – Equal Form Equal Variance & Equal Latent Mean

TITLE: Initial 2-Group gp4e_gp4a CFA

DATA: FILE IS C:\Users\Fatma\Documents\Data\Dissertation\gp_4e_gp_4a.dat;
FORMAT IS F1.0,F3.0,1x,45F1.0,2x,F4.2;

VARIABLE: NAMES ARE group subj it1-it45 Profic_i;
USEVARIABLES ARE  it5 it9 it14 it22 it31 it36 it39 it44;
MISSING ARE profic_i (9.00);
CATEGORICAL ARE it5 it9 it14 it22 it31 it36 it39 it44;
GROUPING IS group (4=Gp4A 5=Gp4E);

ANALYSIS: ESTIMATOR=WLSMV;
Type=General;
PARAMETERIZATION=THETA;
DIFFTEST IS UnqVAR4e4a.dat

MODEL: GMD BY it5 it9 it14 it22 it31 it36 it39 it44;
!it5 (1);  it9 (2); it14 (3); it22 (4); it31 (5);
!it36 (6); it39(7); it44 (8); !Equal Errors
GMD (1);                     ! Equal Factor Variance

Model Gp4E:
[GMD@0];                   ! CONSTRAINT ON LATENT MEAN

SAVEDATA: DIFFTEST IS EqVAR4e4a.dat;

OUTPUT: SAMPSTAT MODINDICES (10.00) STANDARDIZED RESIDUAL;
Appendix D7: Testing acculturation as a Covariate in the MGCFA: MIMIC Model

TITLE: Initial 2-Group gp_2_gp_4E CFA INTERCEPTS

DATA: FILE IS C:\Users\Fatma\Documents\Data\Dissertation\gp2V2_gp4EV2.dat; FORMAT IS F1.0,F3.0,1x,45F1.0,2x,F4.2;

VARIABLE: NAMES ARE group subj it1-it45 Profic_i;
           USEVARIABLES ARE it5 it9 it14 it22 it31 it36 it39 it44 profic_i;
           ! MISSING ARE profic_i (9.00);
           CATEGORICAL ARE it5 it9 it14 it22 it31 it36 it39 it44;
           GROUPING IS group (2=Gp2 4=Gp4E);

ANALYSIS: ESTIMATOR=WLSMV;
           TYPE=General;
           PARAMETERIZATION = THETA;
           DIFFTEST IS MIMICbase2_4e.dat;

MODEL: GMD BY it5 it9 it14 it22 it31 it36 it39 it44;
        GMD on Profic_i;
        !it5 (1); it9 (2); it14 (3); it22 (4); it31 (5); it36 (6); it39(7); it44 (8); !Equal Errors
        GMD (1);
        ! Equal Factor Variance

        GMD by Profic_i; !MINMIC covariate;
Model Gp4E: !GMD by Profic_i;
        !Profic_i=0 on Gp2;

        [GMD@0] ! CONSTRAINT ON LATENT MEAN

!SAVEDATA: DIFFTEST IS MIMICbase2_4e.dat;

OUTPUT: SAMPSTAT MODINDICES(ALL) RESIDUAL STAND TECH1 TECH4;
Appendix E

Instruments
Appendix E1: The Arabic Translated Version of the Acculturation Scale

مقياس التعلم لدى العرب
ضع دائرة حول رقم الاجابة المناسبة على المقياس من 1 الى 4

**استخدام اللغة**

<table>
<thead>
<tr>
<th>تقريبا دائما</th>
<th>غالبا</th>
<th>أحيانا</th>
<th>تقريبا أبدا</th>
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<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
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</tbody>
</table>

1. كم مرة في الغالب تتحدث اللغة الانجليزية؟
2. كم مرة في الغالب تتحدث اللغة الانجليزية مع أصدقائك؟
3. كم مرة في الغالب تفكر باللغة الانجليزية؟
4. كم مرة في الغالب تتحدث اللغة العربية؟
5. كم مرة في الغالب تفكر باللغة العربية؟

**المهارة اللغوية**

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<thead>
<tr>
<th>جيد جدا</th>
<th>جيد</th>
<th>ضعيف جدا</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
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</table>

7. ما هي قدراتك على التحدث باللغة الانجليزية؟
8. ما هي قدراتك على القراءة باللغة الانجليزية؟
9. ما هي قدراتك على استيعاب برنامج التلفزيون باللغة الانجليزية؟
10. ما هي قدراتك على استيعاب برنامج الراديو باللغة الانجليزية؟
11. ما هي قدراتك على الكتابة باللغة الانجليزية؟
12. ما هي قدراتك على فهم الموسيقى باللغة الانجليزية؟
13. ما هي قدراتك على التحدث باللغة العربية؟
14. ما هي قدراتك على القراءة باللغة العربية؟
15. ما هي قدراتك على استيعاب برنامج التلفزيون باللغة العربية؟
16. ما هي قدراتك على استيعاب برنامج الراديو باللغة العربية؟
17. ما هي قدراتك على الكتابة باللغة العربية؟
18. ما هي قدراتك على فهم الموسيقى باللغة العربية؟
Appendix E1: The Arabic Translated Version of the Acculturation Scale (continued)

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<th>تقريبًا دائما</th>
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## مقياس الثقافة بالذات

هذا الاستبيان يتكون من فقرات تصف وجهة نظرك حول نفسك والآخرين و حول الحياة بشكل عام. من فضلك اجب على الفقرات التالية باختيار الإجابة المناسبة التي تقييم مدى تفكك نفسك. لكل فقرة ضع دائرة حول الرقم الذي يصف وجهة نظرك.

1 = دائمًا 
2 = غالبا 
3 = أحياناً 
4 = نادراً 
5 = أبدًا صحً

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<th>العقلية</th>
<th>ملاحظات</th>
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Appendix E2: The Arabic Translated Version of the BPCS
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</tr>
<tr>
<td>25</td>
<td>الأخرون يحاولون اعاقة قدرتي في توجيه حياتي</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>26</td>
<td>ما يحدث لي هو عن عبارة حظ حسن أو سوء</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>27</td>
<td>عندما يعترض شيء طبيعي اعتراض عليه</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>28</td>
<td>أستطيع أن أكون ما أريد</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>29</td>
<td>أعرف كيفية الحصول على ما أريد من الآخرين</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>30</td>
<td>القدر هو وراء فشلي</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>31</td>
<td>بعوينة الله أستطيع أن أكون ما أريد</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>32</td>
<td>أنا ضحية للظروف الخارجية عن استطاعتي</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>33</td>
<td>أستطيع أن أتحكم بإفكاري</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>34</td>
<td>يحدث لي شيء لا أستطيع التحكم به</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>35</td>
<td>كلما تعرضت عقبة ما أحاول بجد التغلب عليها لتحقيق هدفي</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>36</td>
<td>إذا سلمت نفسي بين يدي الله أحقق أي شيء</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>37</td>
<td>أنا تحت رحمة قدرتي الجسدية</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>38</td>
<td>في حياتي كل ما يحدث لي هو مقدر</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>39</td>
<td>تصرفاتي هي مسيرة من قبل الله</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>40</td>
<td>أنا ضحية للصعاب الاجتماعية</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>41</td>
<td>التحكم في حياتي يعتمد على العمل أكثر من اعتمادة على المادة</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>42</td>
<td>عندما أريد شيئا أثبت نفسي من الحصول عليه</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>43</td>
<td>فكرة الالعبي الذي ليس لدي أي سيطرة عليه يتحكم ب حياتي</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>44</td>
<td>إذا رغبت بشيء دعوت الله لتحقيقه</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>45</td>
<td>حقيقة أنا ليست لدي سيطرة على مسيرة حياتي</td>
<td>5 4 3 2 1</td>
</tr>
</tbody>
</table>
Appendix E3: The Back Translated Version of the Acculturation Scale

Measuring learning of Arabs
Circle the appropriate answer on a scale from 1 to 4

<table>
<thead>
<tr>
<th>Language use</th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Language use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Almost always</strong></td>
<td><strong>often</strong></td>
<td><strong>sometimes</strong></td>
<td><strong>Almost never</strong></td>
<td></td>
</tr>
<tr>
<td>Almost always</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you speak in English? 1</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you speak English with your friends? 2</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you think in English? 3</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you speak Arabic with your friends? 5</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you think in Arabic? 6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Language competence</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Language competence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Very well</strong></td>
<td><strong>well</strong></td>
<td><strong>weak</strong></td>
<td><strong>Very weak</strong></td>
<td></td>
</tr>
<tr>
<td>Very well</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you speak English? 7</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you read English? 8</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you understand TV programs in English? 9</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you understand radio programs in English? 10</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you write in English? 11</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you understand songs in English? 12</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you speak Arabic? 13</td>
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<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you read Arabic? 14</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you understand radio programs in Arabic? 15</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you understand radio programs in Arabic? 16</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How well do you write in Arabic? 17</td>
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<tr>
<td>4</td>
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<td>2</td>
<td>1</td>
<td>How well do you understand songs in Arabic? 18</td>
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</table>
Appendix E3: The Back Translated Version of the Acculturation Scale (continued)

<table>
<thead>
<tr>
<th>Almost always</th>
<th>often</th>
<th>sometimes</th>
<th>Almost never</th>
<th>Question</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you usually watch TV programs in English?</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you usually listen to radio programs in English?</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you usually listen to English songs?</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you usually watch TV programs in Arabic?</td>
<td>22</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you usually listen to radio programs in Arabic?</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>How often do you usually listen to Arabic songs?</td>
<td>24</td>
</tr>
</tbody>
</table>
Appendix E4: Back Translated Version of the Measurement of Self Confidence

This survey includes statements that describe how you view yourself, others, and like in general. Please, respond to the following statements by choosing the correct answer that measures how self confident you are. For each statement, circle the number that describes your view.

1 = always
2 = often
3 = sometimes true
4 = rarely
5 = never true

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I can make things happen easily.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>To get what you want depends on knowing the right people.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>The rules of society control my actions.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>I can get over obstacles by trying persistently</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>I can achieve success with God’s help.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>I think that luck plays a bigger role in my life than my abilities</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>If nothing happens, I take initiative and make things happen.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>I am the only one responsible for consequences in my life.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>I depend on God to help control my life</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>I refuse to give in or stop trying despite obstacles.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>My success is a matter of luck.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Getting what you want is a matter of being in the right place at the right time.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>I am able to effectively control the others behavior</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>If I need help I know that God is there to help me</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>I feel that others have more control on my life than I do</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>There is very little I can do to change my destiny.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>I think I can control my life like other people do.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>God rewards me for following his orders</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>I am not in control on my abilities.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>I keep trying to achieve my goals even if others quit trying.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>I cannot control many things in my life.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix E4: Back Translated Version of the Measurement of Self Confidence
(continued)

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>God helps me take control of my life</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>23</td>
<td>Compared to others, I am in charge of my life.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>24</td>
<td>I try hard to do things myself.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>25</td>
<td>Others try to undermine my ability to direct my life.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>26</td>
<td>What happens to me is a matter of good or bad luck.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>27</td>
<td>When something stands in my way, I object to it.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>28</td>
<td>I can be anything I want.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>29</td>
<td>I know how to get what I want from others.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>30</td>
<td>Fate is behind my failure.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>31</td>
<td>With God’s help, I can be anything I want to be.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>32</td>
<td>I am a victim of circumstances that I do not control.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>33</td>
<td>I can control my thoughts.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>34</td>
<td>Things that I have no control over happen to me.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>35</td>
<td>Whenever I face an obstacle, I try hard to overcome it to achieve my goal.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>36</td>
<td>If I submit to God, I can do anything.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
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<tr>
<td>37</td>
<td>I am limited by my physical abilities.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>38</td>
<td>Everything that happens in my life is predestined.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>39</td>
<td>My actions are determined by God.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>40</td>
<td>I am a victim of social pressure.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>41</td>
<td>Taking charge of my life depends on rationality more than material things.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>42</td>
<td>When I want something I prove myself by getting it.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>43</td>
<td>My subconscious which I have no control over is in charge of my life.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>44</td>
<td>If I want something I pray to God to make it true.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
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<tr>
<td>45</td>
<td>Actually, I have no control over where my direction in life.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
Appendix F

HSIRB Approval Letter