Measurement Invariance of Two Adaptive Performance Scales Across Multiple Groups

By

Courtney Allen

A thesis submitted to the graduate faculty in partial fulfillment of the requirements for the

degree of

Master of Arts in Psychology

Middle Tennessee State University

May 2019

Dr. Mark Frame, Advisor

Dr. Glenn Littlepage, Committee Member

Dr. Michael Hein, Critical Reader

ACKNOWLEDGEMENTS

I am so grateful for the many people who have supported me throughout the thesis process and graduate school. First, I would like to thank my advisor, Dr. Mark Frame, for always believing in me and encouraging me to stretch myself. Completing this study is a huge personal accomplishment that I couldn't have finished without your guidance and support. Somehow you talked me into doing all kinds of things, like factor analysis, that I never would have attempted on my own, but turned out to be rewarding learning experiences. Thank you for being a great thesis advisor and support system throughout my time as a graduate student!

I would also like to thank committee members Dr. Glenn Littlepage and Dr. Michael Hein for their interest in this project and their thoughtful critiques along the way. This study is absolutely better because of your involvement.

Finally, thank you to my friends and family for their constant support. From listening to me worry about deadlines to figuring out how to number the pages of the thesis document, finishing this project and graduate school was possible because I had you all to lean on.

ABSTRACT

The purpose of this study is to examine the degree to which two adaptive performance scales, the I-ADAPT-M and the MAP, demonstrate measurement equivalence. If measurement equivalence is supported, then the scale may be used by various groups at various times because it is consistently interpreted. A simultaneous confirmatory factor analysis (SCFA) was conducted to determine the statistical robustness of each scale. Three participant groups, consisting of law enforcement agents, the general population, and students from a university in the Southeast, responded to the scales and their data were used for the analysis. The results indicate that the neither the I-ADAPT-M nor the MAP scales achieved full measurement equivalence. Mean differences among the groups for each scale were examined. Future research should focus on revising the scale items.

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CHAPTER I: INTRODUCTION AND LITERATURE REVIEW

Adaptability is key for the current workforce because of constant changes in the environment. Most business and industry fields must evolve to incorporate newer technology, more diversity in people (employees, customers, etc.), and updated laws and regulations (Brannick, Levine, & Morgeson, 2007). Employees who can adjust to changes and excel in a fast-paced environment can be vital to organizational success. Developing a reliable measure of an individual's adaptability would be a first step toward having a valid process for hiring and promoting employees. Such a measure could lead to better selection and employee development decisions in addition to better research.

Research on adaptability at work has led to the development of scales designed to ascertain how adaptable an individual is in work settings. One scale developed by Ployhart and Bliese (2006) is the Individual Adaptability Measure (I-ADAPT-M). Another scale, the Measure of Adaptive Performance (MAP), was initially developed around the same time but has continued to be refined and shows promise as a useful measure (Marlow, Calarco, Frame, & Hein, 2015). Both scales must be tested further empirically to determine if they can be used reliably in diverse situations with different populations. More specifically, each should be tested for measurement equivalence to determine if they are robust across samples from three different populations. Measurement invariance is a statistical characteristic of a scale. If a scale has achieved measurement invariance, then it measures the same construct across more than one group of people. This provides evidence that diverse people at different times interpret the scale in the same way conceptually. Without support for measurement invariance, using the scale allows data to be collected that might or might not be relevant for the purpose it is

being collected for. It is not providing sound data. To test a scale for measurement invariance, a simultaneous factor analysis (SCFA) is performed that examines the underlying statistical structure of responses to the scale.

The present study will test for invariance, which will determine the extent to which both measures' factor loadings are consistent across the groups. A critical first step toward determining the measurement equivalence of the I-ADAPT-M and the MAP will be done by comparing the responses provided by employees from the general population, a state-wide law enforcement agency, and students from a university in the Southeast.

If the adaptive performance models function the same way for multiple groups, the practical usefulness of the scales will be bolstered in a meaningful and important way. The establishment of measurement equivalence would provide statistical permission to further investigate the means of the three groups and shed light on the specific adaptive performance profiles of each of the groups. I/O psychologists are typically interested in the use of relevant pre-employment measures for job applicants and candidates for various occupations and careers; thus, the degree to which measures such as the I-ADAPT-M and the MAP are comparable to different groups of incumbents and applicants is of particular concern.

What Is Adaptive Performance?

While most people have an idea of what is meant when they say someone is adaptable (or not adaptable), consensus regarding the definition of adaptive performance has not yet been reached in the research community. Jundt, Shoss, and Huang (2015) explained that researchers have been using multiple terms, definitions of terms, and approaches to operationalizing adaptive performance. For example, terms such as

"adaptability" or "flexibility" could be defined in a similar way or one researcher could consider adaptive performance an inherent trait while another considers it a skill that can be learned. Previous research has also measured adaptive performance in different ways (Good, 2014; Han & Williams, 2008; Shoss, Witt, & Vera, 2012). This variation has made it difficult to draw conclusions about what adaptive performance is or what its outcomes might be.

Although the adaptive performance constructs lack conceptual clarity, there are a few broad areas of agreement within the literature. Adaptive performance is a multidimensional construct (Griffin & Hesketh, 2003; Pulakos, Arad, Donovan, & Plamondon, 2000) that captures an aspect of job performance other than task and contextual performance (Han & Williams, 2008). Although there is a lack of conceptual clarity about adaptive performance, O'Connell, McNeely, and Hall (2008) propose that it is the "capacity to change and the motivation and competence to do so." Adaptive performance is usually considered to be an ability or a set of behaviors in anticipation of or in response to an externally imposed change (Shoss et al., 2012). Many researchers also agree that it is environmentally or context dependent, which means that different jobs require different manifestations of adaptability (Ployhart & Bliese, 2006).

Adaptive performance is distinct from, but related to, other concepts such as flexibility, coping, problem solving, self-regulation, organizational change, and newcomer socialization (Jundt et al., 2015). These research streams can shed light on adaptive performance and contribute to a greater understanding of adaptable performance at work. Flexibility is a term that is often used interchangeably with adaptability, which causes conceptual confusion, but it is likely one aspect of adaptability and not

synonymous with adaptability. Flexibility is defined as the ability to allow one's thoughts

and action to change (Griffin & Hesketh, 2003; Onwezen, Veldhoven, & Biron, 2014).

While flexibility could be important to adaptability because it means that a person has the

ability to change, adaptability implies acting to adjust as needed to the situation (Good,

2014). Other conceptualizations of flexibility, such as psychological flexibility, are

concerned with remaining open and non-judgmental before making a decision in order to

reduce cognitive load (Onwezen et al., 2014), which may indirectly inform adaptive

performance.

      Coping may also be related to adaptive performance because it consists of "efforts

to prevent or reduce the negative effects of stress on well-being" (Edwards, 1992, pg. 16).

Change and uncertainty, which are inherent to an environment that requires an individual

to adapt, can be stressful. Coping with that stress in a way that still allows for desirable

levels of performance is important. Pulakos et al. (2000) determined "handling work

stress" as one of the eight dimensions of adaptive performance, indicating that coping

plays a significant role.

      Openness has been explored in relation to adaptive performance in multiple

studies (Good, 2014; Griffin & Hesketh, 2003; Mumford, Baughman, Threlfall, Uhlman,

& Costanza, 1993; Pulakos, Schmitt, Dorsey, Arad, Borman, & Hedge, 2002; Stokes,

Schneider & Lyons, 2010). It is generally defined as openness to experience as

understood in the five-factor model of personality, but it has also been incorporated into

specific variables such as "cognitive openness" or "openness to others." Individual

openness means being open-minded and intellectually curious as well as having a

preference for variety. Appreciating variety and being open to new ideas probably allow

individuals to be adaptable. The literature supports openness as a dimension or predictor

of adaptive performance (Griffin & Hesketh, 2003; Pulakos et al., 2002).

Previous Adaptive Performance Research

There have been attempts to identify predictors of adaptive performance.

Theoretical distal antecedents of adaptive performance include individual differences,

training techniques and learning strategies, as well as job, task, and contextual factors.

More proximal theoretical antecedents include motivation/self-regulation and cognitive

processes/behavioral strategies (Jundt et al., 2015).

Conclusions from empirical work support biodata as a useful tool for predicting

adaptive performance (Griffin & Hesketh, 2005). If an individual has had experience with

adaptive behaviors in the past, then he or she should be more successful using adaptive

behaviors in the future. Cognitive ability and achievement motivation also have been

found to significantly predict adaptive performance (Pulakos, et al., 2002).

Much of the adaptive performance literature has been concerned with identifying

correlates of adaptive performance domains to establish convergent and discriminant

validity of the adaptive performance constructs. Studies of the five-factor model of

personality—which includes openness to experience, conscientiousness, extraversion,

agreeableness, and neuroticism—have found that conscientiousness is positively related

to adaptive performance. Neuroticism was found to be negatively related to it (Ono,

Sachau, Deal, Englert, & Taylor, 2011; Shoss, et al., 2012). The other factors do not have

a significant relationship with adaptive performance. Griffin and Hesketh (2005) further

explored the correlation between conscientiousness and adaptive performance by

identifying sub-components of conscientiousness and determining the extent to which

each of them also had a positive relationship with adaptive performance. The first conscientiousness component, cautiousness/dependability, includes dutifulness, deliberation, and order. The other component, achievement, includes competence, self-discipline, achievement-striving. Only the achievement component had a significant positive relationship with adaptive performance; the cautiousness components were nonsignificant (Griffin & Hesketh, 2005).

In addition to conscientiousness, Mumford et al. (1993) found that people who performed well on both well-defined and ill-defined tasks, which would seem to be equivalent to task and adaptive performance respectively, were disciplined, concerned with creative achievement, and not defensive. Another study by O'Connell et al. (2008) found support for human factors such as employability, occupational status, education, and tenure having a positive relationship with performance in an organization that had experienced significant changes in its industry, which required employees to demonstrate adaptable performance.

Sometimes variables moderate the relationships that result in adaptive performance. For example, emotional control has been found to increase adaptive performance (Niessen & Jimmieson, 2016). Other research findings of interest indicate that individual adaptive performance can improve team adaptive performance (Han & Williams 2008). Also, psychological flexibility, a construct similar to elements of adaptive performance, was found to reduce emotional exhaustion but increase job performance (Onwezen et al., 2014). Although this research is about a construct that is related to adaptive performance rather than adaptive performance itself, it provides key insights that adaptive performance may act as a moderator for other constructs. This

claim is supported by Jundt et al. (2015), who call for greater interdisciplinary study within the adaptive performance research stream.

Models of Adaptive Performance

Pulakos et al. (2000) developed an influential taxonomy of adaptive performance. They began by creating items with reference to the Job Productivity Index. The items were piloted by over 3,000 participants, which included members of the U.S. Army, research scientists, and nonmanagerial employees from a telecommunications company. The largest group was the nonmanagerial employees. Analyses of the data resulted in eight dimensions of adaptive performance: Dealing with Uncertain/Unpredictable Work Situations, Handling Emergency/Crisis Situations, Solving Problems Creatively, Handling Work Stress, Learning New Tasks/Technologies/ Procedures, Demonstrating Interpersonal Adaptability, Cultural Adaptability, and Demonstrating Physically Oriented Adaptability. See Table 1 for the dimension definitions. Subsequent research has found support for most of the factors identified by Pulakos et al. (2000), except for the physically oriented adaptability, which might only be relevant for a certain subset of jobs, like the military.

Table 1. Definitions of the Eight Dimensions of Adaptive Performance

Dimensions Title	Dimension Definition
Handling Emergencies or Crisis Situations	Reacting with appropriate and proper urgency in life threatening, dangerous, or emergency situations; quickly analyzing options for dealing with danger or crises and their implications; making split-second decisions based on clear and focused thinking; maintaining emotional control and objectivity while keeping focused on the situation at hand; stepping up to take action and handle danger or emergencies as necessary and appropriate.
Handling Work Stress	Remaining composed and cool when faced with difficult circumstances or a highly demanding workload or schedule; not overreacting to unexpected news or situations; managing frustration well by directing effort to constructive solutions rather than blaming others; demonstrating resilience and the highest levels of professionalism in stressful circumstances; acting as a calming and settling influence to whom others look for guidance.
Solving Problems Creatively	Employing unique types of analyses and generating new, innovative ideas in complex areas; turning problems upside-down and inside-out to find fresh, new approaches; integrating seemingly unrelated information and developing creative solutions; entertaining wide-ranging possibilities others may miss, thinking outside the given parameters to see if there is a more effective approach; developing innovative methods of obtaining or using resources when insufficient resources are available to do the job.
Dealing with Uncertain and Unpredictable Work Situations	Taking effective action when necessary without having to know the total picture or have all the facts at hand; readily and easily changing gears in response to unpredictable or unexpected events and circumstances; effectively adjusting plans, goals, actions, or priorities to deal with changing situations; imposing structure for self and others that provide as much focus as possible in dynamic situations; not needing things to be black and white; refusing to be paralyzed by uncertainty or ambiguity.
Learning Work Tasks, Technologies, and Procedures	Demonstrating enthusiasm for learning new approaches and technologies for conducting work; doing what is necessary to keep knowledge and skills current; quickly and proficiently learning new methods or how to perform previously unlearned tasks; adjusting to new work processes and procedures; anticipating changes in the work demands and searching for and participating in assignments or training that will prepare

	self for these changes; taking action to improve work performance deficiencies.
Demonstrating Interpersonal Adaptability	Being flexible and open-minded when dealing with others; listening to and considering others' viewpoints and opinions and altering own opinion when it is appropriate to do so; being open and accepting of negative or developmental feedback regarding work; working well and developing effective relationships with highly diverse personalities; demonstrating keen insight of others' behavior and tailoring own behavior to persuade, influence, or work more effectively with them.
Demonstrating Cultural Adaptability	Taking action to learn about and understand the climate, orientation, needs, and values of other groups, organizations, or cultures; integrating well into and being comfortable with different values, customs, and cultures; willingly adjusting behavior or appearance as necessary to comply with or show respect for others' values and customs; understanding the implications of one's actions and adjusting approach to maintain positive relationships with other groups, organizations, or cultures.
Demonstrating Physically Oriented Adaptability	Adjusting to challenging environmental states such as extreme heat, humidity, cold, or dirtiness; frequently pushing self physically to complete strenuous or demanding tasks; adjusting weight and muscular strength or becoming proficient in performing physical tasks as necessary for the job.

Table 1. Adapted from: Adaptability in the workplace: Development of a taxonomy of adaptive performance (p. 617), by E. D. Pulakos, S. Arad, M. A. Donovan, & K. E. Plamondon, 2000, Journal of Applied Psychology, 85(4), 612-624.

Developed by Ployhart and Bliese (2006), I-ADAPT is another model of adaptive performance (See Figure 1). The theory conceptualizes adaptability as a stable individual difference which is distinctly different from adaptive performance because adaptability is considered a composite KSAO rather than an aspect of task performance. Defining adaptability as a composite KSAO reflects the multidimensional nature of the construct. The more distal, stable KSAOs include cognitive ability, personality, values and interests, and physical ability that directly precede individual differences in adaptability.

KSAO
- Cognitive Ability
- Personality
- Values and Interests
- Physical Abilities

Environmental Adaptability Requirements

Change

Stable   Dynamic

Proactive

Reactive

Individual Adaptability
- Crisis
- Work Stress
- Creativity
- Uncertainty
- Learning
- Interpersonal
- Cultural
- Physical

Performance
- Task
- Contextual
- Counter-productive
- Etc.

Mediating Processes

Situation Perception and Appraisal

Knowledge Acquisition

Situation Selection

Self-Regulation and Coping

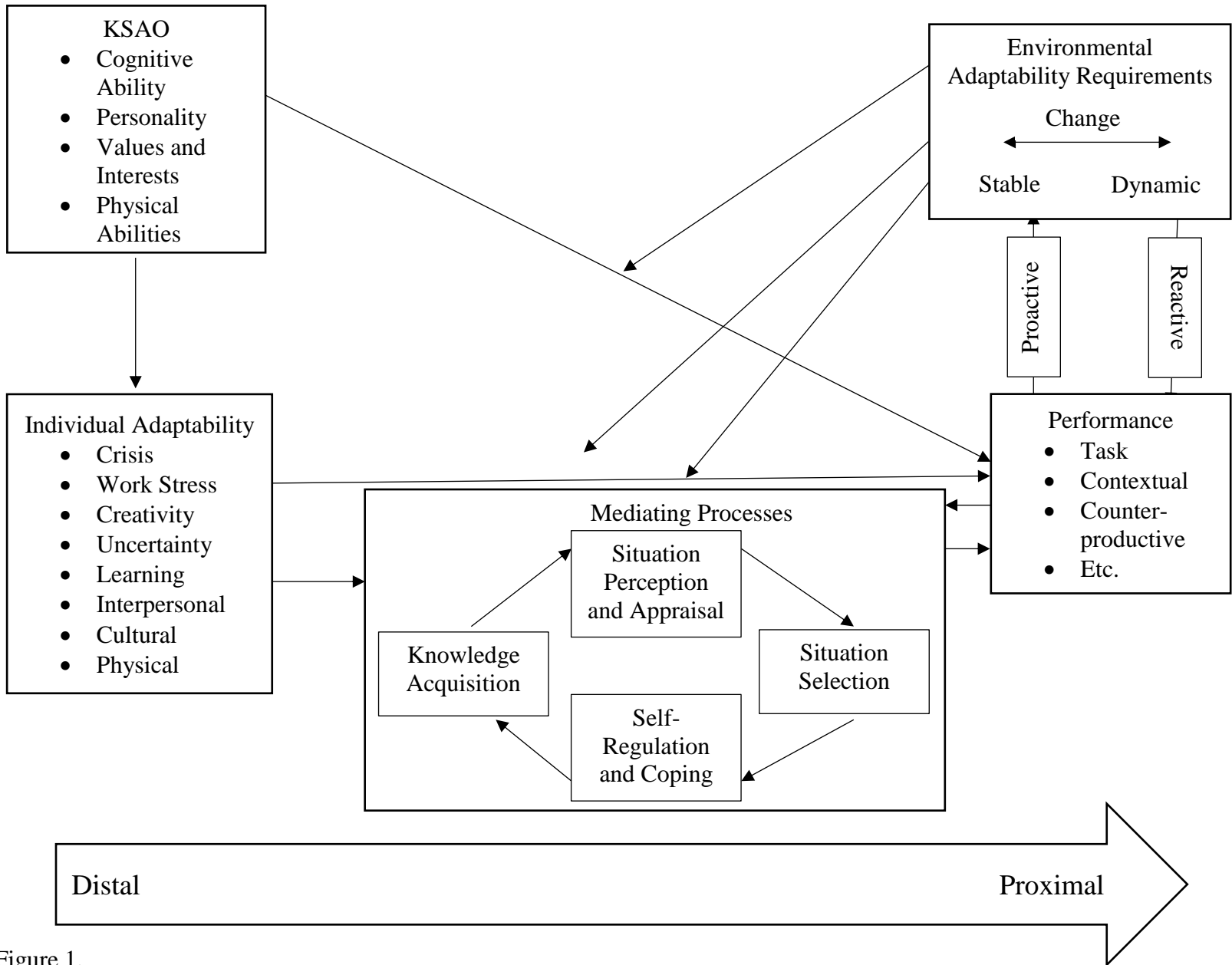Distal   Proximal

Figure 1.

Conceptualizing adaptability as a composite of KSAOs also allows the I-ADAPT measure, called the I-ADAPT-M, to be potentially more useful because the measure captures a wider range of circumstances. The I-ADAPT-M is a self-report scale that is general and short enough (55 questions in its short form) that busy individuals in a variety of organizations could complete it in a timely manner.

The Measure of Adaptive Performance (MAP) approaches adaptive performance from a behavioral perspective. Initially developed by Frame, Roberto, and Rigdon, the MAP items and dimensions were revised and analyzed multiple times (Lillard, Watts, Frame, Hein, Rigdon, & Orsak-Robsinson, 2012; Watts, Frame, Rigdon, and Orsak-Robinson, 2011).

Early versions of the MAP drew heavily form the Job Productivity Index (Pulakos et al., 2000) and the adaptive performance dimensions created by Pulakos et al. (2000) to create 41 items for the scale. The most recent version of the MAP contains 63 items which produce a robust 9-factor model of adaptive performance that was identified using exploratory factor analyses and confirmed through subsequent confirmatory factor analyses (Marlow et al., 2015). The MAP is a self-report scale that assesses the following dimensions: Applied Creativity, Adaptability in Crisis Situations, Cultural Adaptability, Emotional Control, Emotional Perceptiveness, Flexibility of Opinion, Openness to Criticism, Proactive Learning, and Dealing with Ambiguous Situations (See Table 2 for the dimension definitions).

Table 2. Marlow et al. (2015) Measure of Adaptive Performance Dimensions

Dimensions Title	Dimension Definition
Applied Creativity	Uniquely analyzing information and generating new, innovative approaches to problems
Adaptability in Crisis Situations	Reacting with appropriate and proper urgency in unexpected, unstable, dangerous, or emergency situations; quickly analyzing options for dealing with threats to important goals, values, income, or health
Cultural Adaptability	Learning about, integrating with, and respecting the cultures, customs, and values of others
Emotional Control	Maintaining control over one's feelings and responses in challenging or stressful situations
Emotional Perceptiveness	Quickly being able to understand the feelings, motivations, and behaviors of others
Flexibility of Opinion	Willingly changing one's own behavior, appearance, judgments, and beliefs based on the opinions of others when it is appropriate to do so
Openness to Criticism	Being open and accepting of feedback from various sources; seeking out such feedback when appropriate
Proactive Learning	Demonstrating enthusiasm for learning new approaches and technologies; taking responsibility for keeping knowledge and skills current
Dealing with Ambiguous Situations	Effectively adjusting plans, goals, actions, or priorities to deal with changing situations even in unclear circumstances.

Adaptive Performance in Different Groups

As discussed previously, adaptive performance is an aspect of job performance other than task and conceptual performance which is likely environmentally or context dependent. Thus, it is reasonable to believe that different jobs and occupations require different degrees of adaptive performance and that the individuals in different occupations or jobs would report differing levels of adaptive performance.

Law enforcement is an occupation that requires employees to think and behave in specific ways that civilians would not. For example, law enforcement officers must be regularly prepared to enter into a life-threatening situation and to defend themselves

and/or defuse tense situations. The circumstances of the job are often unknown, requiring the officer to take in information and adjust appropriately. This includes being aware of the environment, analyzing people, and determining the intentions of others (Ortmeier, 2002). These high-stakes, unknown situations are a significant difference from the way an employee in a field unrelated to law enforcement would need to behave. It is reasonable, therefore to suspect that law enforcement officers may score high on all of the I-ADAPT-M dimensions except Learning Work Tasks, Technologies, and Procedures and Cultural Adaptability. Similarly, law enforcement officers may score high on the MAP factors of adaptability in Crisis, Emotional Control, Emotional Perceptiveness, and Dealing with Ambiguous Situations.

Yet, some aspects of law enforcement jobs are similar to other occupations. They are still required to do detail-oriented paperwork, work with others on team tasks, and might or might not have the opportunity to learn and train above a mandatory level (Ortmeier, 2002). These circumstances would not elicit more adaptability in law enforcement employees than those in other occupations. Additionally, although many individuals in law enforcement might excel at cultural awareness and adaptability, some contend that it is not yet a common strength among policing organizations (Cummings, 2017). The MAP factors that may have similar mean differences when comparing law enforcement personnel and the general population include Flexibility of Opinion, Openness to Criticism, Cultural Adaptability, and Proactive Learning. These are more likely to reflect individual differences and not be elicited by law enforcement work.

Measurement Invariance

The present study will examine the extent to which two measures of adaptive performance (the I-ADAPT-M and the MAP) are invariant across multiple samples. Establishing measurement equivalence will determine if the scales are conceptually interpreted consistently by different people. It is important to know if a scale is interpreted in the same way by different groups because scales are taken by diverse subjects at various times. If different groups respond to the same scale in a way that indicates that they are not interpreting it in the same way, then comparisons between the groups lack substantive import (Zobell, Nauta, & Hesson-McInnis, 2018).

An (SCFA) using three sample populations will be conducted on both the I-ADAPT-M and the MAP to ascertain the degree of measurement invariance across the samples. One sample will be adult participants from the general population of the United States, a second sample will be taken from a law enforcement organization that requires its employees to display adaptive performance frequently, and the third sample consists of students from a university in the Southeast. The sample populations reflect both the general adult population as well as a specific group of working adults.

This research will test for strong (or scalar) invariance, which means that all of the I-ADAPT-M and MAP factor analytic models hold across multiple groups. More specifically, scalar invariance means the items would have the same factor structure, load onto the appropriate factor, and have the same errors for all of the groups (Zobell, Nauta, & Hesson-McInnis, 2018). If the SCFA results do not indicate scalar invariance, then it could be necessary to revise the measures and re-test them for scalar invariance before using it for research or practical purposes.

Although both the I-ADAPT-M and the MAP are intended to assess adaptive performance, the items on each scale were written using different strategies. Based on the different types of items in both scales – with the I-ADAPT-M items tending toward situational (What would you do?) and MAP items tending toward behavioral (What have you done?) – there could be significant differences in how the two measures operate. Therefore, this research will also check for strong (or scalar) invariance for the I-ADAPT-M across the same sample populations as the MAP.

CHAPTER II: METHODS

Previous exploratory factor analysis (EFA) research for the I-ADAPT-M and

MAP has already been completed (Marlow et al., 2015). Along with factor analyzing the

scales, studies have examined the extent to which the measures predict employee

engagement (Marlow, 2016), job satisfaction (Calarco, 2016), in-basket performance, and

situational judgement test performance (Seyfang, 2018). The previously cited studies

were conducted using disparate groups of people. In this study, a simultaneous

confirmatory factor analysis (SCFA) will be conducted using three groups of people to

test for measurement equivalence.

Research Questions

The following questions will be explored using the I-ADAPT-M and MAP.

Research Question 1: Is there measurement equivalence among the General Population,
Law Enforcement, and Student groups on the I-ADAPT-M?

Research Question 2: If there is measurement equivalence among the General
Population, Law Enforcement, and Student groups on the I-ADAPT-M, are there mean
differences among the groups on the dimensions of the scale?

Research Question 3: Is there measurement equivalence among the General Population,
Law Enforcement, and Student groups on the MAP?

Research Question 4: If there is measurement equivalence among the General
Population, Law Enforcement, and Student groups on the MAP, are there mean
differences among the groups on the dimensions of the scale?

Participants and Procedures

The present study utilized archival data from multiple research projects. The

General Population data included 654 participants whose responses were collected in an

online survey in early 2016. The survey was open to adults through the Internet. The

participants were asked to answer demographic questions, such as age and gender, as

well as their education levels, employment status, and student status. Five measures were included in the online survey, but only two are of interest in the present study: the I-ADAPT-M and the MAP.

To prepare the data for analysis, participants that had missing data and responded inattentively were removed (See Measures for more information about quality assurance items). Only missing data from the scale were used to determine whether a participant should be removed, not missing demographic data. After preparing the data for the I-ADAPT-M analysis, 497 participants remained. For the MAP analysis, 416 participants remained. See Table 3 for demographic information from the General Population group.

Table 3. Demographics of General Population Group

		I-ADAPT-M	MAP
Gender	Male	131	123
	Female	308	290
Age	18-29	162	156
	30-39	131	121
	40-49	52	48
	50-59	62	60
	60-69	26	24
	70-79	6	4
Ethnicity	White	339	317
	Black	30	30
	Hispanic/Latino	18	19
	Asian/Pacific Islander	31	26
	Bi-racial/Mixed	16	16
	Other	2	2
Education level	Less than high school	5	4
	High school	52	52
	Some college	139	138
	College	153	134
	Postsecondary degree	89	84
Currently Employed?	Yes	320	301
	No	118	111

The Law Enforcement data was collected from employees of a state highway patrol agency. Law enforcement employees of this organization responded to the I-ADAPT-M and MAP measures through an online survey in April 2016. The survey began with an informed consent page that asked participants to indicate if they agreed to participate in the study. Next, the participants were asked to indicate their rank and tenure in their current role at the state highway patrol agency. After participants had completed the survey, they were asked demographic questions, such as gender, age, and race.

The Law Enforcement data originally included 732 participants. It was prepared in the same way as the General Population data: participants with missing scale data and inattentive responses were removed. For the I-ADAPT-M, 468 participants remained. 455 participants remained for the MAP. See Table 4 for demographic information.

Table 4. Demographics of Law Enforcement Group

		I-ADAPT-M	MAP
Gender	Male	441	436
	Female	18	17
Age	18-29	45	45
	30-39	112	105
	40-49	189	190
	50-59	107	106
	60-69	3	2
Ethnicity	White	415	405
	Black	27	29
	Hispanic/Latino	2	2
	Native American	3	3
	Asian/Pacific Islander	2	1
	Bi-racial/Mixed	2	3
	Other	5	5

The Student data included 278 participants whose responses were collected in an online survey in early 2016. The survey was open to university student research pool participants and to some upper level undergraduate classes. The participants were asked to answer demographic questions, such as age and gender, as well as their education levels, employment status, and student status.

To prepare the data for analysis, participants that had missing data and responded inattentively were removed. After preparing the data for the I-ADAPT-M analysis, 230 participants remained. 210 participants remained for the MAP analysis. See Table 5 for demographic information from the Student group.

Table 5. Demographic Information of Student Group

		I-ADAPT-M	MAP
Gender	Male	85	82
	Female	141	124
Age	18-29	220	200
	30-39	5	5
	40-49	0	0
	50-59	1	1
	60-69	1	1
Ethnicity	White	143	133
	Black	50	43
	Hispanic/Latino	12	12
	Asian/Pacific Islander	9	8
	Bi-racial/Mixed	7	5
	Other	6	6
Education level	High school	60	53
	Some college	158	145
	College	7	7
Currently Employed?	Yes	170	150
	No	57	57

Measures

    Individual Adaptability Measures (I-ADAPT-M). The I-ADAPT-M measure was developed using Ployhart et al.'s (2000) eight dimensions of adaptive performance. It measures the adaptive performance of an individual. Marlow et al. (2015) tested the I-

ADAPT-M factor structure using exploratory factor analysis and found support for the 8-factor model. The following are the dimension scale reliability estimates: Solving Problems Creatively, $\alpha = .73$, Handling Emergency or Crisis Situations, $\alpha = .89$, Demonstrating Cultural Adaptability, $\alpha = .83$, Demonstrating Interpersonal Adaptability, $\alpha = .79$, Learning Work Tasks, Technologies, and Procedures, $\alpha = .87$, Demonstrating Physically Oriented Adaptability, $\alpha = .64$, Handling Work Stress, $\alpha = .86$, Dealing with Uncertain and Unpredictable Work Situations, $\alpha = .74$. Two I-ADAPT-M items were dropped because of low fit and/or reliability (See Appendix B for the items that were removed). This led to a 53-item measure with a mean coefficient alpha reliability estimate of $\alpha = .79$. Participants were asked to self-report how well they believed their behavior matched each I-ADAPT-M item using a 5-point Likert scale (from 1 = "Strongly Disagree" to 5 = "Strongly Agree). An example of an I-ADAPT-M item is "I am an innovative person." See Appendix B for the complete I-ADAPT-M scale.

Measure of Adaptive Performance (MAP). The most recent version of the MAP was utilized in this study (Marlow et al., 2015). The MAP measures adaptive behaviors that the person reports engaging in. All nine dimensions of individual adaptability are included in the MAP. It consists of 63 statements that each correspond to one of the nine dimensions of adaptability. Participants used a 5-point Likert scale (from 1 = "Strongly Disagree" to 5 = "Strongly Agree) to report how well each statement reflects their opinion of their behavior. An example of an item is "I quickly learn new methods to complete work tasks." The 9-factor model from Marlow et al. (2015) reports the following reliability estimates for each dimension: Applied Creativity, $\alpha = .88$, Adaptability in Crisis Situations, $\alpha = .79$, Cultural Adaptability, $\alpha = .90$, Emotional

Control, $\alpha = .81$, Emotional Perceptiveness, $\alpha = .86$, Flexibility of Opinion, $\alpha = .80$,

Openness to Criticism, $\alpha = .80$, Proactive Learning, $\alpha = .84$, Dealing with Ambiguous

Situations, $\alpha = .60$. See Appendix C for the complete MAP scale.

Quality Assurance Items. Quality assurance items were added to both the I-

ADAPT-M and the MAP to test for inattentiveness. Quality assurance items instruct a

participant to choose a certain answer (perhaps a "Strongly Disagree") to ensure that he

or she is carefully reading the items and paying attention to them. The General

Population and Student group I-ADAPT-M included 3 quality assurance items, of which

a participant had to answer 2 correctly to remain in the data set. The Law Enforcement

group answered 2 quality assurance items and was required to answer 1 correctly to

remain in the data set. The Law Enforcement and Student group MAP items included 7

quality assurance items. Participants had to answer 5 correctly to remain in the data set.

The General Population group had 6 quality assurance items included in the MAP and

were required to answer 4 correctly to remain in the data set.

Data Analysis Procedures

The I-ADAPT-M and MAP were analyzed for measurement equivalence across

the three groups using simultaneous confirmatory factor analysis (SCFA) in the statistical

program AMOS. Research questions guided analyses for each of the groups. Data

analyses provided results used to provide evidence of measurement equivalence across

these groups. Measurement equivalence was determined using several statistics derived

from CFA fit indices: Chi-Square, Goodness of Fit Index (GFI), Adjusted Goodness of

Fit Index (AGFI) and Root Mean Square Error of Approximation (RMSEA). These

goodness of fit indices are recognized as important for interpreting model fit (Jöreskog & Sorbom, 1996a; Steiger, 1990).

First, analyses were run to determine if there was measurement equivalence among the three groups of people on the I-ADAPT-M. The factor loadings of the three groups were constrained to be equal to investigate model fit between the three groups. This provided insight about whether the items were behaving the same way for each group as well as whether systematic error was present. If there was measurement equivalence, overall mean differences between the groups would be analyzed using ANOVA in the statistical program SPSS. Next, the same process was done with the MAP.

CHAPTER III: RESULTS

Research Questions

Simultaneous confirmatory factor analyses (SCFA) were conducted to explore research questions 1 and 3 to determine measurement equivalence among the General Population, Law Enforcement, and Student groups for both the I-ADAPT-M and the MAP. One SCFA that included all three groups was conducted for each measure, resulting in two SCFA analyses total. For research questions 2 and 4, multivariate analysis of variance analyses (MANOVA) were conducted to explore mean differences among the three groups on the I-ADAPT-M and the MAP. Additionally, the MANOVA included all of the groups' data and both scales, so comparisons for how each group scored on the two scales could be examined. For example, both the I-ADAPT-M and the MAP have a creativity component; because the MANOVA was conducted with the 17 dimensions of both scales, it is possible to compare the Law Enforcement group's scores on the I-ADAPT-M creativity dimension and the MAP creativity dimension for any differences.

Research Question 1. The first research question is concerned with whether the General Population, Law Enforcement, and Student groups achieve measurement equivalence on the I-ADAPT-M. One SCFA was conducted to answer this question. Four goodness of fit indices were used to help determine if the model was a good fit. CFI, GFI, and AGFI are acceptable when greater than .90 (Diefendorff, Silverman, & Greguras, 2005; Joreskog & Sorbom, 1996). An RMSEA value of .60 or less indicates acceptable model fit (Ryan, West, & Carr, 2003). These guidelines were used to interpret the SCFA results for Research Questions 1 and 3.

See Table 6 for the results of the I-ADAPT-M SCFA. The three criteria listed in Table 6 indicate increasing levels of constraint on the model. The measurement weights indicate whether the three groups load onto the same number of factors as the model tested currently contains. The results of the CFI and GFI are lower than the desired level of 0.90, but they are around the 0.80 range, which is a decent fit for three different groups. The RMSEA is well below the recommended threshold of .06. The structural covariances, which indicate that the same items load onto the appropriate factor for each group, remain similar to the previous, less constrained model. Finally, the measurement residual model indicates whether the error terms for each group are the same. Here the model's fit indices decrease significantly. The GFI is only 0.69 and the CFI is .062, which are low. The RMSEA is at an acceptable level of 0.043. When considering the fit indices for an SCFA with three groups on the I-ADAPT-M, measurement equivalence was partially supported.

Table 6. Measurement Equivalence for General Population, Law Enforcement and Student groups on the I-ADAPT-M

	Degrees of Freedom	Chi Square	GFI	CFI	RMSEA	AGFI
Measurement Weights	3997	8763.536	0.766	0.808	0.032	0.749
Structural Covariances	4053	9200.661	0.759	0.793	0.033	0.745
Measurement Residuals	4159	13438.966	0.689	0.626	0.043	0.679

Research Question 2. Research question 2 asked whether there were mean differences among the three groups on dimension-level scores for the I-ADAPT-M, if measurement equivalence was found. Because few samples will share the same error

terms and the fit indices indicated moderate fit for the measurement weights and

structural covariances models, a MANOVA was conducted to determine if any

differences existed.

  To prepare the data for a MANOVA, average dimension scores for the eight

dimensions of the I-ADAPT-M were calculated so that each participant had one score per

dimension. Then the overall group average for each dimension was calculated.

Cronbach's alpha was calculated for each dimension with the three groups combined,

which provided one alpha level for each I-ADAPT-M dimensions. See Table 7 for the

average dimension scores and alpha levels for the I-ADAPT-M.

Table 7. I-ADAPT-M Average Dimension Scores by Group

Dimension	Alpha	Group	M	SD	N
Handling Emergency or Crisis Situations	0.873	General Population	3.785	0.797	497
		Law Enforcement	4.131	0.465	463
		Student	3.793	0.669	228
Handling Work Stress	0.871	General Population	2.936	0.927	497
		Law Enforcement	3.823	0.573	463
		Student	2.832	0.879	228
Solving Problems Creatively	0.729	General Population	3.845	0.645	497
		Law Enforcement	3.752	0.496	463
		Student	3.776	0.559	228
Dealing with Uncertain and Unpredictable Work Situations	0.771	General Population	3.705	0.613	497
		Law Enforcement	3.886	0.410	463
		Student	3.697	0.524	228
Learning Work Tasks, Technologies, and Procedures	0.862	General Population	4.068	0.613	497
		Law Enforcement	4.007	0.416	463
		Student	4.069	0.552	228
Demonstrating Interpersonal Adaptability	0.768	General Population	4.071	0.540	497
		Law Enforcement	3.975	0.383	463
		Student	4.116	0.448	228
Demonstrating Cultural Adaptability	0.820	General Population	4.1667	0.644	497
		Law Enforcement	3.900	0.532	463
		Student	4.167	0.619	228
Demonstrating Physically Oriented Adaptability	0.538	General Population	3.484	0.621	497
		Law Enforcement	3.841	0.416	463
		Student	3.523	0.566	228

The results of the one-way MANOVA indicated that there were differences on dimension scores depending on which group a participant belonged to, Wilks' Lambda $F(34,1906) = 17.47$, $p < .05$. Univariate tests were conducted to examine which I-ADAPT-M average dimension scores were different based on the group that a participant belonged to. The results indicated that there were significant differences for Handling

Emergency or Crisis Situations (F (2, 969) = 33.443, $p < .01$), Demonstrating Cultural

Adaptability (F (2, 969) = 22.357, $p < .01$), Handling Work Stress (F (2, 969) = , $p <$

.01), Demonstrating Interpersonal Adaptability (F (2, 969) = 176.007, $p = .004$),

Demonstrating Physically Oriented Adaptability (F (2, 969) = 54.255, $p < .01$), and

Dealing with Uncertain and Unpredictable Work Situations (F (2, 969) = 20.358, $p <$

.01).

     Table 8 presents the pairwise comparison results for the differences between the

groups on the I-ADAPT-M dimension scores. More specifically, the Law Enforcement

group participants rated themselves higher on the Handling Emergency or Crisis

Situations, Handling Work Stress, Dealing with Uncertain and Unpredictable Work

Situations, and Demonstrating Physically Oriented Adaptability scores than both the

General Population and Student groups. The Law Enforcement group participants rated

themselves lowest on the Demonstrating Cultural Adaptability dimension when

compared to the other groups. For the dimension Demonstrating Interpersonal

Adaptability, the Student group participants rated themselves higher than the Law

Enforcement group. None of the groups had significantly different scores for the

dimensions Solving Problems Creatively or Learning Work Tasks, Technologies, and

Procedures.

Table 8. Pairwise Comparisons for Average I-ADAPT-M Dimension Scores by Group

Dimension	(I)	(J)	Mean Difference (I-J)	95% CI Lower Bound	95% CI Upper Bound
Handling Emergency or Crisis Situations	General Population	Law Enforcement	.34*	0.23	0.45
	Law Enforcement	Student	.35*	0.22	0.49
	Student	General Population	-0.01	-0.13	0.15
Handling Work Stress	General Population	Law Enforcement	-.90*	0.77	1.03
	Law Enforcement	Student	1.04*	0.87	1.20
	Student	General Population	-0.14	-0.03	0.30
Solving Problems Creatively	General Population	Law Enforcement	0.08	-0.01	0.18
	Law Enforcement	Student	0.00	-0.12	0.12
	Student	General Population	-0.08	-0.03	0.20
Dealing with Uncertain and Unpredictable Work Situations	General Population	Law Enforcement	-.21*	0.12	0.29
	Law Enforcement	Student	.23*	0.12	0.33
	Student	General Population	-0.02	-0.09	0.13
Learning Work Tasks, Technologies, and Procedures	General Population	Law Enforcement	0.06	-0.02	0.15
	Law Enforcement	Student	-0.06	-0.05	0.16
	Student	General Population	-0.01	-0.10	0.12
Demonstrating Interpersonal Adaptability	General Population	Law Enforcement	0.07	0.00	0.15
	Law Enforcement	Student	-.13*	0.03	0.22
	Student	General Population	0.06	-0.04	0.15
	General Population	Law Enforcement	.26*	0.16	0.35

Demonstrating Cultural Adaptability	Law Enforcement	Student	-.26*	0.14	0.38
	Student	General Population	0.01	-0.12	0.13
Demonstrating Physically Oriented Adaptability	General Population	Law Enforcement	-.36*	0.27	0.45
	Law Enforcement	Student	.35*	0.24	0.46
	Student	General Population	0.02	-0.09	0.13

*. The mean difference is significant at the .05 familywise alpha level.

Research Question 3. The third research question asked whether the General

Population, Law Enforcement, and Student groups achieved measurement equivalence on

the MAP. One SCFA was conducted to answer this question. See Table 9 for the results.

Table 9. Measurement Equivalence for General Population, Law Enforcement and Student groups on the MAP

	Degrees of Freedom	Chi Square	GFI	CFI	RMSEA	AGFI
Measurement Weights	5688	11268.922	0.739	0.808	0.03	0.723
Structural Covariances	5760	11674.311	0.732	0.796	0.031	0.718
Measurement Residuals	5886	16311.076	0.652	0.641	0.041	0.642

For the measurement weights model, the results of the CFI and GFI are again

lower than the desired level of 0.90, but remain around the 0.80 range, which verges on a

good fit for three different groups. The RMSEA is far below the .06 threshold. The

structural covariances model is similar to the measurement weights model and has a

decent fit. The measurement residual model fit indices decrease considerably. The GFI is

only 0.652 and the CFI is .0641, which are low. The RMSEA is at an acceptable level of

0.041. When considering the fit indices for an SCFA with three groups on the MAP, measurement equivalence was partially supported.

Research Question 4. Research question 4 asked whether there were mean differences among the three groups on dimension-level scores for the MAP, if measurement equivalence was found. Again, because few samples will share the same error terms and the fit indices indicated moderate fit for the measurement weights and structural covariances models, a MANOVA was conducted to determine if any differences existed.

The average dimension scores for the MAP were determined in the same manner as the I-ADAPT-M scores. Then the overall group average for each dimension was calculated. Cronbach's alpha was calculated for each dimension with the three groups combined, which provided one alpha level for each MAP dimensions. See Table 10 for the average dimension scores and alpha levels for the MAP.

Table 10. MAP Average Dimension Scores by Group

Dimension	Alpha	Group	M	SD	N
Applied Creativity	0.869	General Population	3.760	0.660	413
		Law Enforcement	3.688	0.492	455
		Student	3.742	0.583	207
Adaptability in Crisis Situations	0.782	General Population	3.704	0.759	413
		Law Enforcement	4.147	0.453	455
		Student	3.820	0.594	207
Cultural Adaptability	0.905	General Population	4.071	0.550	413
		Law Enforcement	3.906	0.432	455
		Student	4.060	0.560	207
Emotional Control	0.756	General Population	3.582	0.644	413
		Law Enforcement	3.868	0.375	455
		Student	3.606	0.567	207
Emotional Perceptiveness	0.815	General Population	3.795	0.630	413
		Law Enforcement	3.684	0.466	455
		Student	3.934	0.541	207
Flexibility of Opinion	0.779	General Population	3.565	0.673	413
		Law Enforcement	3.286	0.519	455
		Student	3.622	0.652	207
Openness to Criticism	0.744	General Population	3.669	0.610	413
		Law Enforcement	3.733	0.402	455
		Student	3.746	0.534	207
Proactive Learning	0.868	General Population	3.929	0.577	413
		Law Enforcement	3.929	0.395	455
		Student	3.880	0.535	207
Dealing with Ambiguous Situations	0.617	General Population	3.728	0.615	413
		Law Enforcement	3.933	0.437	455
		Student	3.523	0.566	207

The results of the one-way MANOVA indicated that there were differences on dimension scores depending on which group a participant belonged to, Wilks' Lambda F (34, 1906) = 17.47, p < .05. Univariate tests were conducted to examine which MAP

average dimension scores were different based on the group that a participant belonged to. The results indicated that there were significant differences for Dealing with Ambiguous Situations (F (2, 969) = 17.47, $p < .01$), Cultural Adaptability (F (2, 969) = 11.67, $p < .01$), Emotional Perceptiveness (F (2, 969) = 13.565, $p < .01$), Flexibility of Opinion (F (2, 969) = 27.63, $p < .01$), Emotional Control (F (2, 969) = 35.482, $p < .01$), and Adaptability in Crisis Situations(F (2, 969) = 57.633, $p < .01$).

Table 11 presents the pairwise comparison results for the differences between the groups on the MAP dimension scores. For the Adaptability in Crisis Situations dimension, the Law Enforcement group rated itself highest, followed by the Student group, and, lowest, the General Population group. Student group participants rated themselves highest on the Emotional Perceptiveness dimension, followed by the General Population group. The Law Enforcement group participants rated themselves the lowest on this dimension, compared to the other groups. Similarly, the Law Enforcement group participants rated themselves lowest on the Cultural Adaptability dimension compared to the General Population and Student groups. However, the Law Enforcement group participants rated themselves higher than both the General Population and Student groups on the Emotional Control and Dealing with Ambiguous Situations dimensions. The Law Enforcement group participants rated themselves the lowest on the Flexibility of Opinion dimension compared to the other two groups. None of the groups had significantly different scores for the dimensions Applied Creativity, Openness to Criticism, or Proactive Learning.

Table 11. Pairwise Comparisons for Average MAP Dimension Scores by Group

Dimension	(I)	(J)	Mean Difference (I-J)	95% CI Lower Bound	95% CI Upper Bound
Applied Creativity	General Population	Law Enforcement	.06	-.04	.15
	Law Enforcement	Student	-.02	-.10	.14
	Student	General Population	-.04	-.08	.16
Adaptability in Crisis Situations	General Population	Law Enforcement	-.47*	.36	.57
	Law Enforcement	Student	.34*	.21	.46
	Student	General Population	.13*	.00	.26
Cultural Adaptability	General Population	Law Enforcement	-.16*	.08	.25
	Law Enforcement	Student	-.15*	.05	.26
	Student	General Population	-.01	-.10	.11
Emotional Control	General Population	Law Enforcement	-.30*	.21	.39
	Law Enforcement	Student	.28*	.17	.39
	Student	General Population	.02	-.09	.13
Emotional Perceptiveness	General Population	Law Enforcement	.11*	.02	.20
	Law Enforcement	Student	-.25*	.14	.36
	Student	General Population	.14*	.03	.26
Flexibility of Opinion	General Population	Law Enforcement	.29*	.19	.39
	Law Enforcement	Student	-.31*	.18	.43
	Student	General Population	.02	-.11	.15
Openness to Criticism	General Population	Law Enforcement	-.08	-.01	.16

	Law Enforcement	Student	.01	-.10	.12
	Student	General Population	.07	-.04	.17
Proactive Learning	General Population	Law Enforcement	-.01	-.07	.08
	Law Enforcement	Student	.06	-.04	.17
	Student	General Population	-.05	-.05	.15
Dealing with Ambiguous Situations	General Population	Law Enforcement	-.20*	.11	.30
	Law Enforcement	Student	.21*	.10	.32
	Student	General Population	-.01	-.101	.12

*. The mean difference is significant at the .05 familywise alpha level.

CHAPTER IV: DISCUSSION

The purpose of this study was to determine the extent to which two measures of adaptive performance – the I-ADAPT-M and the MAP– would achieve measurement equivalence across three distinct groups. Determining if one or both measures is statistically robust could lead to furthering the adaptive performance research and eventually allow the construct to inform practice. Adaptive performance is a construct that could be useful for employee selection and development purposes but remains conceptually unclear.

The first research question concerned the degree of measurement equivalence for the I-ADAPT-M across three groups: General Population, Law Enforcement, and Students. The results indicate that although the I-ADAPT-M is close to the desired thresholds that indicate equivalence, the scale does not meet or exceed them. This means that the I-ADAPT-M scores can be tentatively compared across different groups, although further research and revisions of the scale may be needed before it is used widely in research or practice.

The mean differences on the eight I-ADAPT-M dimensions were analyzed to examine how the participants' self-reports compared to each other. The Law Enforcement group rated themselves highest, when compared to the other two groups' self-ratings, on dimensions related to work ambiguity, stress, and physical ability. All three groups rated themselves similarly on the creativity and learning dimensions, however. These results indicate that the I-ADAPT-M does differentiate between different people and could allow for further insights into certain groups' adaptive performance profiles or abilities.

The third research question asked the degree to which measurement equivalence was supported for the MAP across the three participant groups. Again, the results indicate that the MAP scale comes close to meeting the measurement equivalence criteria but falls short. It was still deemed useful to examine the mean differences for the nine MAP dimensions to explore how the different groups rated themselves.

The mean differences indicate that, like the I-ADAPT-M results, the groups rated themselves similarly on the creativity and learning dimensions. The MAP also includes an Openness to Criticism dimension, which they also rated comparably. The Law Enforcement group continued to rate themselves highest on dealing with crises, ambiguous situations, and emotional stability. The Student group participants rated themselves highest for Emotional Perception, which reflects that they also rated themselves highest on Interpersonal Adaptability on the I-ADAPT-M. These findings indicate that the groups differ on adaptive performance in interesting ways that could be explored further in the future.

The results of the current study indicate that a degree of measurement invariance exists in both the I-ADAPT-M and the MAP when they are tested across three distinct groups. Additionally, there are interesting and interpretable differences between the participants groups' self-ratings. This indicates that future research and practice could benefit from a revised, improved I-ADAPT-M and MAP.

Limitations

The SCFAs conducted in this study were based on a model developed by previous researchers (Marlow et al., 2015). If this model inaccurately or insufficiently captured the factors of the I-ADAPT-M and the MAP, then the SCFAs would not be meaningful.

Additionally, although the three groups of people in this study are fairly representative of the adult population in the U.S., future research could be done to examine measurement equivalence using larger samples and across more diverse settings, cultures, and occupations. For example, data collected from an Asian country or a different profession than law enforcement could be compared to the current data to see if one or both adaptability scales remain equivalent.

Another limitation is that the data for both the I-ADAPT-M and the MAP were collected at the same time in a long survey (over 100 questions). Open-ended comments that accompanied the survey indicated that many of the respondents disliked taking such a long survey and were unhappy at the time they were completing it. Taking the two scales one after the other and having a negative attitude could have affected the self-ratings used to perform the SCFA.

Future research should focus on re-writing and editing items in each scale. Improving the items so that each group interprets the scale in the same way would allow for measurement equivalence. Then the scales could be used for research and other practical purposes.

Conclusion

The purpose of this study was to determine the degree of measurement equivalence of the I-ADAPT-M and the MAP using three different groups of participants. Although confirmatory factor analyses have been performed for each measure, an SCFA would determine that the scale is interpreted the same way by various types of people. The SCFA performed in this study provided some evidence for measurement equivalence

but indicated that both scales need further revisions to achieve robust measurement equivalence.

  Practical Implications. The mean differences of the three groups indicated interesting and interpretable differences among the groups. This suggests that with improved measures, adaptive performance scales could be used to learn about the adaptive performance abilities of individuals and groups, which could be used like other scales to select for employment or identify areas for development.

  Research Implications. The results of the study indicate that the degree of measurement equivalence for both the I-ADAPT-M and the MAP are below the desired thresholds. Therefore, the scales may be used with caution for research or practical purposes. Eventually, the scales should be revised until and a new SCFA conducted to examine whether measurement equivalence has been achieved. If this occurs, the adaptive performance research would benefit from a statistically robust measure that can be used to collect data.

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APPENDICES

APPENDIX A: IRB APPROVAL LETTER

IRB
INSTITUTIONAL REVIEW BOARD
Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN007 – EXEMPTION DETERMINATION NOTICE

Friday, February 08, 2019

Principal Investigator	**Courtney Allen** (Student)
Faculty Advisor	Mark Frame
Co-Investigators	Michael Hein and Glenn Littlepage
Investigator Email(s)	*ca4h@mtmail.mtsu.edu; mark.frame@mtsu.edu*
Department	Psychology
Protocol Title	***Measurement equivalence of AP study***
Protocol ID	**19-1172**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXEMPT** review mechanism under 45 CFR 46.101(b)(2) within the research category *(4) Study involving existing data* A summary of the IRB action and other particulars in regard to this protocol application is tabulated as shown below:

IRB Action	**EXEMPT from furhter IRB review***	Date	**2/8/19**
Date of Expiration	<mark>NOT APPLICABLE</mark>		
Sample Size	REFER 16-1098 and 18-1180		
Participant Pool	**Data previously collected from Healthy Adults (18 or older)**		
Exceptions	NONE		
Mandatory Restrictions	1. Participants must be 18 years or older 2. Informed consent must be obtained from the participants 3. Identifying information must not be collected		
Restrictions	**1. All restrictions for exemption apply.** **2. Not approved for new data collection: analysis of data collected using 16-1098 and 18-1180.** **3. Prohibited from collecting audio/video data.**		
Comments	NONE		

***This exemption determination only allows above defined protocol from further IRB review such as continuing review. However, the following post-approval requirements still apply:
- Addition/removal of subject population should not be implemented without IRB approval
- Change in investigators must be notified and approved
- Modifications to procedures must be clearly articulated in an addendum request and the proposed changes must not be incorporated without an approval
- Be advised that the proposed change must comply within the requirements for exemption

APPENDIX B: INDIVIDUAL ADAPTABILITY MEASURE (I-ADAPT-M)

I-ADAPT-M

Below are the directions and rating scales used in the current study for the I-ADAPT-M items. Two items from the original I-ADAPT-M scale were not used in the analyses as a result of work by Marlow and Calarco (2016) (item 20 "I can only work in an orderly environment" and item 39 "I tend to perform best in stable situations and environments"). Reverse-scored items are indicated with an "**R**."

This survey asks a number of questions about your preferences, styles, and habits at work. If you are not currently employed, please take former employment, or experience as a student, into consideration when answering the following. Read each statement carefully. Then, for each statement choose the corresponding option that best represents your opinion. There are no right or wrong answers.

1 = Strongly Disagree
2 = Disagree
3 = Neither Agree nor Disagree 4 = Agree
5 = Strongly Agree
6 = Not Applicable

I-ADAPT-M Items by Dimension:

Handling Emergency or Crisis Situations

1. I am able to maintain focus during emergencies
9. In an emergency situation, I can put aside emotional feelings to handle important tasks
12. I think clearly in times of urgency
17. I am able to be objective during emergencies
22. I usually step up and take action during a crisis
27. I make excellent decisions in times of crisis

Handling Work Stress

3. I usually over-react to stressful news **R**
15. I feel unequipped to deal with too much stress **R**
21. I am easily rattled when my schedule is too full **R**
32. I am usually stressed when I have a large workload **R**
35. I often cry or get angry when I am under a great deal of stress **R**

Solving Problems Creatively

10. I see connections between seemingly unrelated information
16. I am good at developing unique analyses for complex problems
24. I am an innovative person
36. When resources are insufficient, I thrive on developing innovative solutions
37. I am able to look at problems from a multitude of angles

Dealing with Uncertain and Unpredictable Work Situations

23. I need for things to be ''black and white'' **R**
28. I become frustrated when things are unpredictable **R**
29. I am able to make effective decisions without all relevant information
40. When something unexpected happens, I readily change gears in response
43. I can adapt to changing situations
47. I perform well in uncertain situations
52. I easily respond to changing conditions
54. I can adjust my plans to changing conditions

Learning Work Tasks, Technologies, and Procedures

5. I take responsibility for acquiring new skills
11. I enjoy learning new approaches for conducting
31. I take action to improve work performance deficiencies
34. I often learn new information and skills to stay at the forefront of my profession
38. I quickly learn new methods to solve problems
44. I train to keep my work skills and knowledge current
46. I am continually learning new skills for my job
49. I take responsibility for staying current in my profession
53. I try to learn new skills for my job before they are needed

Demonstrating Interpersonal Adaptability

4. I believe it is important to be flexible in dealing with others
7. I tend to be able to read others and understand how they are feeling at any particular moment
18. My insight helps me to work effectively with others
30. I am an open-minded person in dealing with others
33. I am perceptive of others and use that knowledge in interactions
42. I try to be flexible when dealing with others
50. I adapt my behavior to get along with others

Demonstrating Cultural Adaptability

2. I enjoy learning about cultures other than my own
6. I work well with diverse others
14. It is important to me that I respect others' culture
19. I enjoy the variety and learning experiences that come from working with people of different backgrounds
25. I feel comfortable interacting with others who have different values and customs

Demonstrating Physically Oriented Adaptability

8. I am adept at using my body to complete relevant tasks
13. I utilize my muscular strength well
26. If my environment is not comfortable (e.g., cleanliness), I cannot perform well **R**
41. I would quit my job if it required me to be physically stronger **R**
45. I physically push myself to complete important tasks
48. I can work effectively even when I am tired
51. I cannot work well if it is too hot or cold **R**
55. I keep working even when I am physically exhausted

APPENDIX C: MEASURE OF ADAPTIVE PERFORMANCE (MAP)

Measure of Adaptive Performance (MAP)

Below are the directions and scales used in the current study for the MAP items. Reverse-scored items are indicated with an "**R**."

This survey asks a number of questions about your preferences, styles, and habits at work. If you are not currently employed, please take former employment, or experience as a student, into consideration when answering the following. Read each statement carefully. Then, for each statement choose the corresponding option that best represents your opinion. There are no right or wrong answers.

1 = Strongly Disagree
2 = Disagree
3 = Neither Agree nor Disagree 4 = Agree
5 = Strongly Agree
6 = Not Applicable

MAP Items by Dimension:

Applied Creativity

38. I analyze information in unique ways
39. I generate new ideas in novel situations
40. I turn problems upside-down and inside-out to find fresh, new approaches
41. I integrate seemingly unrelated information and develop creative solutions
42. I entertain wide-ranging possibilities others may miss
43. I think outside the given parameters to see if there is a more effective approach
44. I develop innovative methods of obtaining resources when faced with insufficient
45. I create unique ways to use existing resources when the desired resources are unavailable

Adaptability in Crisis Situations

12. I am not a good person to rely on in life threatening, dangerous, or emergency situations **R**
21. I react with appropriate and proper urgency in life threatening, dangerous, or emergency situations
22. I make split-second decisions based on clear and focused thinking
23. I quickly analyze options for dealing with danger or crises and their implications
25. I step up to take action and handle danger or emergencies as necessary and appropriate

Cultural Adaptability

4. I respect the culture of other people
6. I enjoy working with people of different backgrounds
7. I learn about the needs and values of other people and cultures
8. I take action to understand other groups, organizations, and cultures
11. I integrate well with people from different cultures
13. I am able to become comfortable with people with different values and customs
15. I remain flexible and open-minded when dealing with others
16. I listen to and consider others' viewpoints and opinions
18. I work well in developing effective relationships with highly diverse personalities
60. I get along with people from different countries
61. I get along with people of different religious beliefs

Emotional Control

26. I remain composed when faced with difficult circumstances
27. I remain calm when faced with a highly demanding workload
28. I manage frustration by directing effort to constructive solutions
29. I maintain high levels of professionalism in difficult situations
46. I maintain a sense of humor in emotionally challenging situations
47. I maintain control over my negative emotions
48. I hide my emotions easily
63. There are some emotions that I cannot control **R**

Emotional Perceptiveness

9. I am able to read the emotions of others well
10. I can understand how other people are feeling at any particular moment
19. I demonstrate keen insight of others' behavior
24. I maintain emotional control and objectivity while keeping focused on the situation at hand
49. I understand others' emotions quickly
50. I know when people are frustrated with me
59. I have the ability to determine other people's expectations

Flexibility of Opinion

14. I would willingly alter my behavior to show respect for others' values and customs
20. I tailor my behavior to persuade or influence others
55. I alter my own action when it is appropriate to do so based on the opinions of others

56. I willingly adjust my behavior as necessary to show respect for others
57. I willingly alter my appearance if necessary to comply with others' values and customs
58. I change my behavior when it is appropriate to the situation
62. I alter my own opinion when it is appropriate to do so

Openness to Criticism

17. I can be open and accepting of negative or developmental feedback regarding my work
51. I see other people's criticism of my work as an opportunity to improve
52. I continuously ask for constructive criticism
53. I am open to feedback from others, even if they do not know as much as I do
54. I accept criticism from those who have not been around as long as I have been

Proactive Learning

30. I demonstrate enthusiasm for learning new approaches and technologies for conducting work
31. I do what is necessary to keep my knowledge and skills current
32. I quickly learn new methods to complete work tasks
33. I adjust to new work processes and procedures
34. I anticipate changes in the work demands
35. I actively participate in training that will prepare me for change
36. I seek out assignments that will prepare me for change
37. I take action to improve work performance deficiencies

Dealing with Ambiguous Situations

1. I take effective action when necessary without having to know the total picture or have all the facts at hand
2. I readily and easily change gears in response to unpredictable or unexpected events and circumstances
3. I deal with situations that are not black and white
5. I refuse to be paralyzed by uncertainty or ambiguity