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Predictors of Cognitive Skills Development Among International Students: Background Characteristics, Precollege Experiences, and Current College Experiences

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ABSTRACT

For international students, seeking a tertiary education outside of their home countries has been a common practice for centuries. However, recent years have brought a significant influx in the number of international students entering the United States to procure a postsecondary education. In 2018–2019, Open Doors (Institute for International Education, 2019) reported an increase in the number of international students studying in the United States for the 14th consecutive year. Because maintaining this stream of international students is of utmost importance to university officials, they strive to meet the educational goals of this student population. Understanding factors that impact the academic achievement of international students is critical. The background characteristics, precollege characteristics, and college experiences of international students have been found to predict cognitive skills development, and cognitive skills development has been linked to optimal academic achievement and student satisfaction.

Keywords: cognitive skills development, international students, writing proficiency

INTRODUCTION

Invested individuals in higher education understand the importance of maintaining a steady stream of international students for the health of their institutions and their domestic student bodies. Although the benefits are many, the financial benefit alone of international student enrollment warrants the attention of higher education personnel. Higher education faculty and staff recognize that if these students are not well served, they may choose another destination for their tertiary education. Hence,

before the background characteristics, precollege experiences, and college experiences can be scrutinized for their impact on cognitive skills development and academic achievement among international students, a few definitions are included for clarity. For this article, international education refers to the education that transcends a country's borders through the exchange of students (Hoffa, 2007) and has been recorded in written history for nearly a thousand years (M. Lee, 2015).

Although the University of Takshasila, located in present-day Pakistan, received scholars from 600 B.C. to 250 A.D., and is credited with educating the first international scholars, welcoming students from other countries onto higher education campuses in the United States did not begin until 1784 (Jenkins, 1983). Moreover, the United States has remained the primary destination of international students for decades (Chow, 2015). In 2016, international students studying in the United States exceeded a million for the first time (Institute for Higher Education, 2019). Garcia and de Lourdes Villarreal (2014) explained this growth in international students coming to the United States as the result of students being unable to meet their academic and social needs at tertiary institutions in their home countries. According to Hemsley-Brown (2012), specific reasons for choosing the United States have included suitability, academic reputation, job prospects, teaching quality, geographical location, ease of travel, family influence, and advertising media. Although not the only country offering scientific disciplines in English, Chevalier (2014) added that the need for improving their English proficiency in these fields, in addition to the above reasons, is one more attractor for international students.

Although critics of the influx of international students on college and university campuses in the United States have suggested that the provision of student services for this population is a financial drain (Banjong & Olsen, 2016), and costs some native workers their employment (Shih, 2015), the benefits associated with enrolling large numbers of international students far exceed the current financial investment.

Mamiseishvili (2012) suggested that national, global, institutional, and individual benefits accompany incoming international students. Regarding national benefits, NAFSA (2019) reported that international students studying at U.S. colleges and universities added $41.0 billion to the U.S. economy as well as supported over 458,290 jobs in the 2018–2019 academic year. Another benefit has been the increase in advanced degrees in specialized fields. Currently, international students comprise more than half of the advanced science, technology, engineering, and math degrees in the United States (Ruiz & Budiman, 2018). If these students remain in the United States, they add to the intellectual capital of this country (J. J. Lee & Rice, 2007) and "relieve the demographic pressures of an aging population" (Moore et al., 2016, p. 858). Still another benefit has been the interaction of domestic students with international students as preparation for future jobs in which cultural competency is a necessity (de Guzman et al., 2016).

Globally, the presence of international students on U.S. higher education campuses reaps additional benefits. For example, Matthews (2017) noted that goodwill and cooperation tend to grow among nations when their leaders have studied in the United States. Second, collaboration among professors, domestic students, and international students has resulted in scientific and technical research that has benefitted the entire world (Saidi-Kuehnert, 2016). Although not an exhaustive list,

still another benefit is the increase in cultural diversity that the presence of international students on U.S. higher education campuses brings to domestic students (Kington, 2014). Bartell (2003) noted that this cultural diversity equips international and domestic students alike with intercultural and international understanding so they can "interrelate as responsible, knowledgeable, and informed global citizens" (BrckaLorenz & Gieser, 2011, p.1).

College and universities benefit as well. First, the sensitivity and understanding of domestic students are increased toward students from other cultures as the domestic students interact with international students who hold different perspectives and experiences (Moore et al., 2016). Pearson (2019) reported, "Diversity enriches the educational experience and improves learning outcomes for *all* students" (para. 1). Second, international students enter the United States with more work experience and developed skills than domestic students in certain fields, which leads to more sophisticated research. According to Trice (2003), engineering and public health are two fields that have been significantly advanced as a consequence of the work experiences of talented graduate international students in their home countries. Third, the presence of high-performing international students increases the prestige of a higher education institution and boosts its academic quality (Garcia & Villarreal, 2014). Fourth, the higher tuition fees offset the reduction of state funding for higher education (England-Siegerdt, 2013; Grapevine Project, 2020; Hegarty, 2014). Finally, international students benefit higher education campuses in the United States because they strengthen existing departments by serving as teaching and graduate assistants in such disciplines as science, engineering, and technology (APAGS Committee for the Advancement of Racial and Ethnic Diversity, 2016; Ruiz & Budiman, 2018).

Hence, the above paragraphs confirm the many national, global, campus, and individual benefits that accompany international students entering the United States to study at its higher education institutions. However, international students face many challenges as well. Some of these challenges are language barriers, pedagogical differences, loneliness, homesickness, identity issues, legal problems, cultural misunderstandings, unclear communication, gastronomic disruptions, and financial difficulties (such as tuition, living expenses, health insurance; Gautum et al., 2016; Mahmood, 2014; Moore et al., 2016). Despite these challenges, courageous international students continue to seek a tertiary education from U.S. higher education institutions for their quality and prestige.

Purpose

The purpose of this study was to explore the relationships among background characteristics, precollege characteristics, and current college characteristics among international students attending highly selective institutions on the U.S. West Coast and to examine how these relationships affect cognitive skills development. Understanding these relationships is critical if the appropriate support programs are to be designed which ensure that international students are able to achieve their academic goals. Thriving current international students help to maintain the stream of international students entering the United States for their tertiary degrees. The

many benefits associated with international students have been delineated above. The following hypotheses were developed from the existing literature: (a) The background characteristics, precollege experiences, and current college experiences predict cognitive skills development; (b) the contributions of these predictors to cognitive skills development vary; and (c) the entry-level of writing proficiency affects cognitive skills development.

Significance

This research study is significant because its findings inform higher education leaders of the predictors of cognitive skills development among international students, identify the college experiences that enhance these intellectual skills, and address the academic growth of this student population. Identification of these predictors and college experiences provides guidance for university personnel as they implement support programs that ensure the greatest cognitive skills growth among international students. International students who are able to master their academic objectives complete their degree programs satisfied and encourage others from their countries to seek their tertiary educations in the United States.

LITERATURE REVIEW

Cognitive Skills Development

Cognitive skills development has received a number of names, including "critical thinking, reflective judgment, epistemological development and so on" (Pascarella & Terenzini, 2005, p. 155.) For the purposes of this research study, the following definition of cognitive skills development was adopted: The development of intellectural and cognitive skills that lead postsecondary students to more critical and reflexive thinking as well as more sophisticated application of knowledge (Pascarella & Terenzini, 2005).

International Students and Cognitive Skills Development

Hesel (2012) suggested that because many international students have only been exposed to "a pedagogic approach based on memorization and didacticism" (p. 2), they have cited the learning of the three skills of "critical thinking, problem solving, and intellectual creativity" (p. 6) as the single most important reason that they have chosen to study in the United States. The importance that international students place on these three cognitive skills has validated the need for an in-depth exploration of those factors that encourage maximal growth in cognitive skills and academic achievement.

Writing Proficiency

One significant background characteristic that impacts cognitive skills development is the writing proficiency of international students entering U.S. higher education institutions. Martirosyan et al. (2015) identified English writing ability as

a significant contributor to the academic achievement of international students attending highly selective U.S. research universities. Safipour et al. (2017) added that many of these international students struggle with articulating their knowledge because the pedagogical approach has changed from the exam-oriented teaching in their home country to essay writing in their host country. Moreover, many international students come from an academic environment that provides little exposure to the concept and practice of essay and research writing (Safipour et al., 2017). Yet, if international students are to flourish on U.S. campuses, writing research papers must be commonly practiced (Johnstone et al., 2002; VanLehn, 1996).

The writing proficiency of international students has been found to be deficient across all disciplines (Zhang & Mi, 2010). Writing within a discipline requires interaction between the international student and the discipline's principles and facts. In addition to all disciplines being impacted, even the social lives of international students are challenged by inadequate writing skills (J. J. Lee, 2013). Adequate writing proficiency has been found to be one of the most essential academic skills if international students are to flourish academically and avoid significant difficulties with "grammar, accuracy and writing skills" (Zhang & Mi, 2010, p. 382). Singh's (2015) study found the following additional academic writing practices as the most challenging: "writing methodologies, findings/analyses, and literature reviews; using appropriate academic style; writing coherent paragraphs; and expressing ideas in correct English" (p. 16).

Because researchers have found that international students cannot express themselves in English well (Zhang & Mi, 2010), they have discovered some additional challenges. First, faculty struggle to interpret what their international students are trying to convey. Second, the longer that international students remain in the United States, the more that they are aware of their inadequacies in English writing expression (Zhang & Mi, 2010). Third, researchers have noted that "the cognitive processes underlying writing skills are inherently difficult to measure and therefore improve" (Johnstone et al., 2002, p. 305).

Zhang and Mi (2010) noted that proficiency in English listening and speaking skills occurs quickly for international students as a result of their exposure to their classroom environment. To improve the English writing of international students, however, mere exposure to an English-speaking environment is not enough. These students need many opportunities to practice this essential skill and to receive corrective feedback. Researchers have discovered that high-level cognitive functions are involved in English writing, and these functions are not developed in most international students prior to coming to the United States (Hesel, 2002; Zhang & Mi, 2010). Critical to writing proficiency achievement is the ability to plan, synthesize, organize, compose, and revise their writing. Concurring with these researchers, Johnstone et al. (2002) found that writing is a "general problem-solving activity (e.g., articulating and establishing a position on a problem, organizing relevant information, and creating an effectively supported argument) that requires high levels of cognitive ability" (p. 305).

Besides the problem of underdeveloped cognitive functions for writing essays, cultural differences in rhetorical conventions, schemata, and writing perspectives or expectations challenge international students as they strive to achieve academically

at U.S. higher education institutions (Zhang & Mi, 2010). New literary skills must be learned if this population group is to thrive in their new environment. Unfortunately, researchers have found that assimilating these cognitive functions takes longer than the students' completion of a college degree (Zhang & Mi, 2010).

College Experiences

Relationships among cognitive skills development and background characteristics, precollege experiences, and current college experiences have been found as predictors of academic achievement. In addition to writing proficiency, of primary interest to this researcher were those college experiences that could enhance the cognitive skills development among international students. Even though J. J. Lee (2010) noted that some colleges and universities in the United States assume that international students are "resourceful and resilient" and do not need additional student support, the challenges faced by international students underscore the need for explicit college experiences that encourage cognitive skills growth. The identified college experiences in this research study were learning strategies, language barriers, educational systems, academic culture shock, learning styles, cognitive fatigue, family, stress, student engagement, critical thinking, first-year courses, motivation, study time, informal mentoring, academic involvement, and faculty-student interaction.

Conceptual Framework

Guiding this study of cognitive skills development among international students was Astin's (1993) inputs-environment-outcomes (I-E-O) model. Astin (1993) defined the *inputs* as "characteristics of the student at the time of initial entry to the institution" (p. 7). The *environment* "refers to the various programs, policies, faculty, peers, and educational experiences to which the student is exposed" (p. 7). The *outcomes* "refer to the student's characteristics after the exposure to the environment" (p. 7). Applying these definitions, the inputs of this research study would be the background characteristics and precollege experiences; the environment would be the college experiences; and the outcome would be the cognitive skills development.

METHOD

Data Source and Sample

Because international students pursue a quality education, knowledgeable faculty in their respective fields, and strong instruction within their areas of study (Heggins & Jackson, 2003; J. J. Lee & Rice, 2007; Mamiseishvili, 2010), a large survey, conducted by a research-oriented university system embodying the above characteristics, was selected. The 2012 University of California Undergraduate Experience Survey (UCUES) served as the data source for this research study. This biannual statewide survey "solicits student opinions on a broad range of undergraduate students' academic and co-curricular experiences, including instruction, advising, and student services"

(http://studentsurvey.universityofcalifornia.edu/). Only the core set of survey questions was utilized for the purposes of this research study to preserve the integrity of the dataset. The University of California Office of the President managed all student responses to the instrument's questions.

Approximately 172,873 students participated in this survey. Of these participants, 7,637 of these students (4.4%) were international students. According to Open Doors (International Institute of Education, 2019), China continues to send the most students to universities in the United States. India and South Korea are the next two largest sending countries. In total, students from these countries comprise more than half of the total international student population. Based on Open Door's findings, one can justify that the composition of international students participating in the UCUES survey is similar to statistics above.

Because the stated purpose of this research study was to explore the impact of background characteristics and college experiences as predictors of cognitive skills development among international students, the study sample was restricted to junior and senior international students. Of this number, 875 international students provided the needed responses to make the data meaningful. Fifty-four percent of this analytical sample were female, 9% were first-generation college students, and 7% learned to speak English after the age of 16.

Variables

For this research study, the researcher utilized 68 variables from the UCUES survey (see Table 1 for a list of the variables and their descriptive statistics). These variables were then used to create the following latent constructs: critical reasoning engagement, elevated academic interest, faculty–student interaction, and extracurricular activity. To determine the magnitude of cognitive skills development and other learning skills, two hypothesized scales were utilized: one scale focused on the students' self-reported abilities when they began college; the other scale focused on the students' self-reported abilities after they completed college. Of particular interest to this researcher was the writing proficiency of this population group; hence, international students were asked to rate their writing ability when then began college and then again when they completed their tertiary education. These students evaluated their proficiency in writing with a 6-point Likert scale (1 = *very poor*, 2 = *poor*, 3 = *fair,* 4 = *good*, 5 = *very good*, 6 = *excellent*.

Table 1: Means and Standard Deviations of the UCUES 2012 Questions (*N* = 875)

Question	*M*	*SD*
6-point Likert scale[a]		
Contributed to class discussion	4.14	0.27
Brought up ideas or concepts from different courses during class discussions	3.67	1.29
Asked an insightful question in class	3.47	1.35

Question	*M*	*SD*
Found a course so interesting that you did more work than was required	3.79	1.28
Chosen challenging courses, when possible, even though you might lower your GPA by doing so	4.14	1.33
Made a class presentation	3.29	1.48
Explain methods, ideas, or concepts and use them to solve problems	4.93	0.92
Break down material into component parts or arguments into assumptions to see the basis for different outcomes	4.61	1.01
Judge the value of information, ideas, actions, and conclusions based on soundness of sources, methods, and reasoning	4.53	1.08
Create or generate new ideas, products, or ways of understanding	4.36	1.12
Used facts and examples to support your viewpoint	4.76	1.02
Incorporate ideas or concepts from different courses when completing assignments	4.40	1.10
Examined how others gathered and interpreted data and assessed the soundness of their conclusions	4.31	1.14
Reconsidered your own position on a topic after assessing the arguments of others	4.35	1.10
Had a class in which the professor knew or learned your name	3.68	1.44
Taken a small research-oriented seminar	2.26	1.49
Communicated with a faculty member by email or in person	4.18	1.26
Talked with the instructor outside of class about issues and concepts derived from a course	3.53	1.38
Interacted with faculty during lecture class sessions	3.31	1.37
Worked with a faculty member on an activity other than coursework (e.g., student organization, campus committee, cultural activity)	2.43	1.53
8-point Likert scale[b]		
Attending movies, concerts, sports, or other entertainment events	2.57	1.11
Performing community service or volunteer activities	1.90	1.22
Participating in physical exercise, recreational sports, or physically active hobbies	0.55	1.14
Participating in spiritual or religious activities	1.67	1.15
Participating in student clubs or organizations	2.22	1.20
Pursuing a recreational or creative interest (arts/crafts, reading, music, hobbies, etc.)	2.46	1.10
Partying	1.75	1.06
Spending time with family	1.83	1.21
Using computer or smart phone for non-academic purposes (games, shopping, email, instant messaging, etc.)	3.87	1.66
Watching TV	1.77	1.15
Study and other academic activities outside of class	4.28	1.65
Socializing with friends	3.16	1.22

Question	*M*	*SD*
6-point Likert scale[c]		
Analytical and critical thinking skills (when you started here)	3.49	1.01
Ability to be clear and effective in writing (when you started here)	3.20	1.00
Ability to read and comprehend academic material (when you started here)	3.44	0.97
Understanding of a specific field of study (when you started here)	3.46	0.98
Ability to speak clearly and effectively in English (when you started here)	3.71	1.19
Analytical and critical thinking skills (current ability level)	4.30	0.88
Ability to be clear and effective in writing (current ability level)	4.11	0.93
Ability to read and comprehend academic material (current ability level)	4.28	0.88
Understanding of a specific field of study (current ability level)	4.48	0.97
Ability to speak clearly and effectively in English (current ability level)	4.42	0.97
Demographics		
Gender (1 = female; 2 = male)	1.55	0.50
Social class (1 = wealthy, 2 = upper middle or professional middle; 3 = middle-class; 4 = working class; 5 = low-income or poort)	2.83	0.81
English knowledge (1 = English is my native language; 2 = before I was 5 yr old; 3 = 6–10 yr old; 4 = 11–5 yr old; 5 = 16+ yrs old)	3.08	1.00
Nonresident college (1 = yes; 0 = no)	1.00	1.00
Parents attended college (1 or more = yes; 0 = no)	1.79	0.78
GPA (0 = <2.0; 1 = 2.01–3.00; 2 = 3.01–4.00; 3 = 4.01–5.00)	2.21	0.48

Note. GPA = grade point average.

[a] 6-point Likert scale values: 1 = never; 2 = rarely; 3 = occasionally; 4 = somewhat often; 5 = often; 6 = very often

[b] 8-point Likert scale values: 1 = 0 hr; 2 = 1–6 hr; 3 = 8–11 hr; 4 = 11–15 hr; 5 = 16–20 hr; 6 = 21–25 hr; 7 = 26–30 hr; 8 = 30+ hr

[c] 6-point Likert scale values: 1 = very poor; 2 = poor; 3 = fair; 4 = good; 5 = very good; 6 = excellent

ANALYSIS

Guided by the recommendations from Tabachnick and Fidell (2007), I screened and cleaned data. Because missing data values invalidate structural equation modeling (SEM), I conducted an analysis of missing data using the Missing Value Analysis (MVA) function of SPSS 22.0 to remove the possibility of patterns. I identified and removed outliers their Mahalanobis distance and used SEM, a very powerful multivariate and confirmatory technique, to explore the hypothesized relationships among background characteristics, precollege experiences, and current college experiences and cognitive skills development. Following the recommendation of

Byrne (2010) to include a hypothesized SEM model that was supported by the seminal literature in path diagram form, Amos 22 software was utilized to graph both the study's underlying theoretical model as well as the final model (see Figure 1).

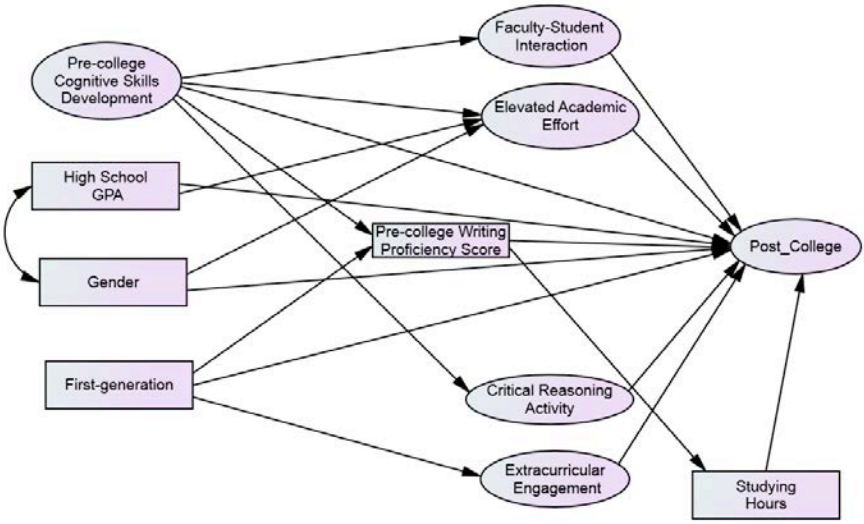

Figure 1: Underlying Theoretical Structural Regression Model with Latent Constructs

Note. Rectangles represent observed variables. Ovals indicate latent variables. One-headed arrows indicate an expected directional relationship between two variables.

RESULTS

Before utilizing SEM, the mean and standard deviation scores were calculated for the 68 variables. Of particular note were the answers to these questions: How proficient were you in these cognitive skills (analytical and critical thinking skills, reading and comprehending academic material, understanding of the field of study, and ability to speak clearly and effectively in English) when you started at this campus? And, how proficient are you now in these cognitive skills (analytical and critical thinking skills, reading and comprehending academic material, understanding of the field of study, and ability to speak clearly and effectively in English)? For their precollege cognitive skills development, international students evaluated themselves from fair to good (M = 3.28 to 3.71). For their postcollege cognitive skills development, international students rated themselves as from good to nearing very good (M = 4.11 to 4.48).

This researcher's next step produced a structural regression model that satisfactorily addressed the research question regarding the contributions of background characteristics, precollege experiences, and current college experiences to cognitive skills development among international students attending highly

selective universities. The resultant model was complex and warranted clarification for greater understanding of the results. Ockey and Choi's (2015) solution to complex structural regression models was the following:

> When models are large, it may be appropriate to separately display measurement models (i.e., the part of the overall model that relates measured variables to latent variables), and structural models (i.e., the part of the model that shows the relationship among the latent variables). When this strategy is used, it should be made clear in both the text and the figure captions that these models are parts of a larger model. If variables, which are deemed to measure the same construct, are bundled together (e.g., item parcels), this construct should also be indicated by the figure and described in the text. Prose that provide logical justification for the bundling scheme should accompany the figures. (pp. 5–6)

SEM utilizes two methods for determining how well the hypothesized structural regression model fits the data. The first method utilizes confirmatory factor analysis to justify the latent variables in the structural model. Table 2 provides the model fit statistics of the latent variables. As Byrne (2010) suggested, the χ^2 statistic is best to determine the goodness-of-fit of models. However, when the datasets are large, as is the UCUES dataset, the χ^2 statistic becomes highly inflated. Therefore, other measurement statistics are necessary. The first additional measurement statistic is the root mean square error of approximation (RMSEA). An adjusted index, the RMSEA identifies the fit between the hypothesized set of observed variables and the latent variable. RMSEA values range between 0 and 1. Noting that all latent factors have RMSEA values of less than one, this researcher confirmed that the indicator variables fit the constructs.

The second measurement statistic depicted in Table 2 is the comparative fit index (CFI). This statistic compares an independent model with no correlations among its independent variables with the hypothetical model. As is true of RMSEA, the CFI values range from 0 to 1, with 1 representing a perfect fit. Researchers agree that CFI values greater than .95 indicate a good fit. All constructs and their associated indicator variables were confirmed with ranges between .988 and .999 (see Figures 2 through 7).

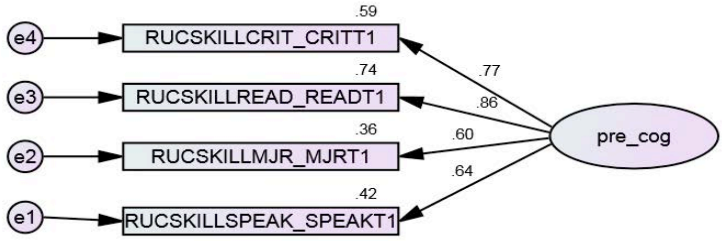

Figure 2: Measurement Model for Precollege Cognitive Development

Note. These indicators comprised the precollege cognitive development latent factor: RUCSKILLCRIT_CRIT1 (analytical and critical thinking skills), RUCSKILLREAD_READT1 (ability to read and comprehend academic material), RUCSKILLMAJR_MAJRT1 (understanding of specific field of study), and RUCKILLSPEAK_SPEAKT1 (ability to speak clearly and effectively in English).

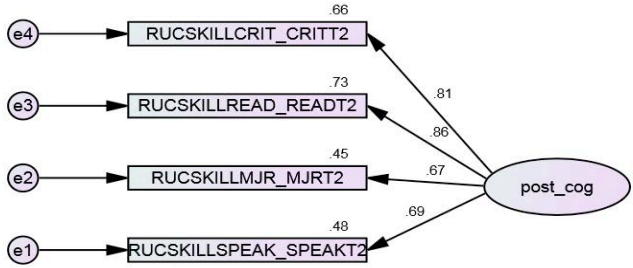

Figure 3: Measurement Model for Postcollege Cognitive Development

Note. These indicators comprised the postcollege cognitive development latent factor: RUCSKILLCRIT_CRIT1 (analytical and critical thinking skills), RUCSKILLREAD_READT1 (ability to read and comprehend academic material), RUCSKILLMAJR_MAJRT1 (understanding of specific field of study), and RUCKILLSPEAK_SPEAKT1 (ability to speak clearly and effectively in English.

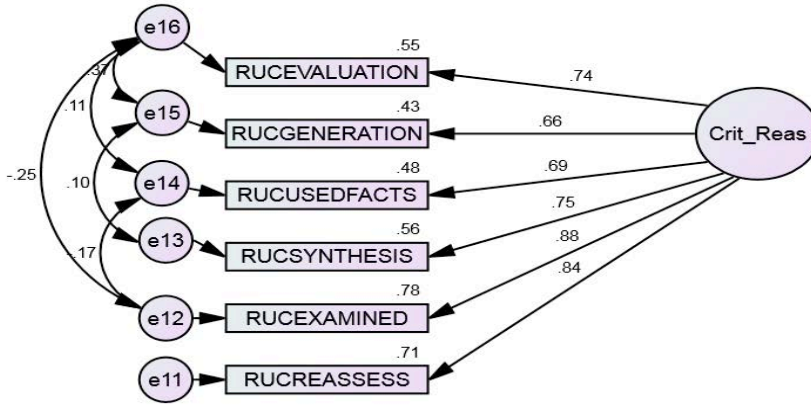

Figure 4: Measurement Model for Critical Reasoning Engagement

Note. These indicators comprised the critical reasoning engagement latent factor: RUCEVALUATION (judge the value of information ideas, actions, and conclusions based on soundness of sources, methods, and reasoning thinking skills), RUCGENERATION (create or generate new ideas, products, or ways of understanding), RUCUSEDFACTS (understanding of specific field of study), and RUCSYNTHESIS (incorporate ideas or concepts from different courses when completing assignments), RUCEXAMINE (examined how others gathered and interpreted data and assessed the soundness of their conclusions), and RUCREASSESS (reconsidered your own position on a topic after assessing the arguments of others**).**

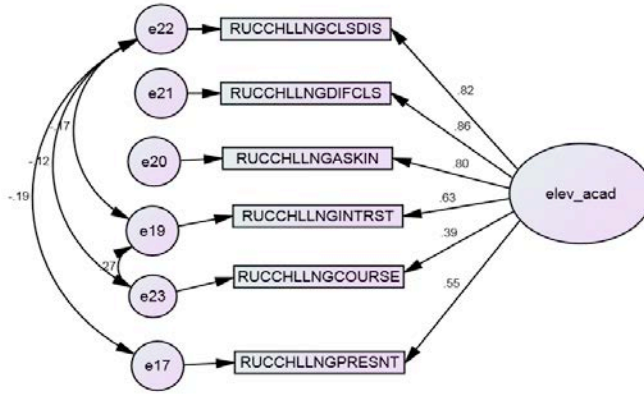

Figure 5: Measurement Model for Elevated Academic Effort

Note. These indicators comprised the elevated academic effort latent factor: RUCCHLLNGCLSDIS (contributed to a class), RUCCHLLNGDISCL (brought up ideas or concepts from different courses during class discussions), RUCCHLLNGASKIN (asked an insightful question in class), RUCCHLLNGINTRST (found a course so interesting that you did more work than was required), RUCCLNGCOURSE (chosen challenging courses, when possible, even though you might lower your GPA by doing so), and RUCCHLLNGPRESNT (reconsidered your own position on a topic after assessing the arguments of others)

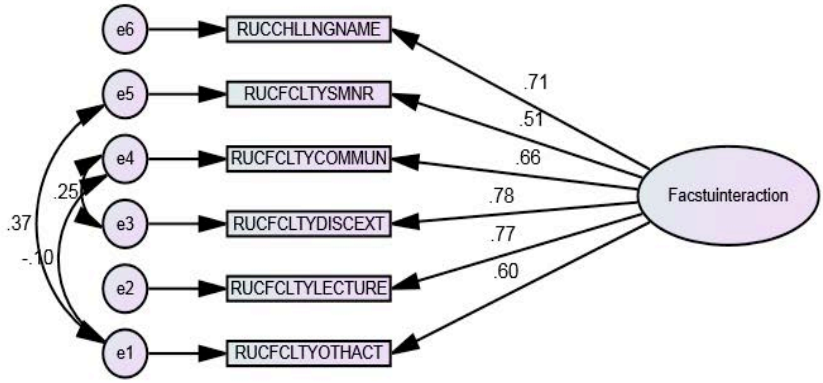

Figure 6: Measurement Model of the Faculty–Student Interaction Latent Construct

Note. These indicators comprised the faculty-student interaction latent factor: RUCCHLLNGNAME (had a class in which the professor knew or learned your name), RUCFCLTYCOMMUN: (communicated with a faculty member by e-mail or in person), RUCFCLTYDISCEXT: (talked with the instructor outside of class about issues and concepts derived from a Course), RUCFCLTYLECTURE: (interacted with faculty during lecture class section), RUCFCLTYOTHACT (worked with a faculty member on an activity other than coursework [e.g., student organization, campus committee, cultural activity), and RUCFACLTYSMNR: taken a small research-oriented seminar with faculty.

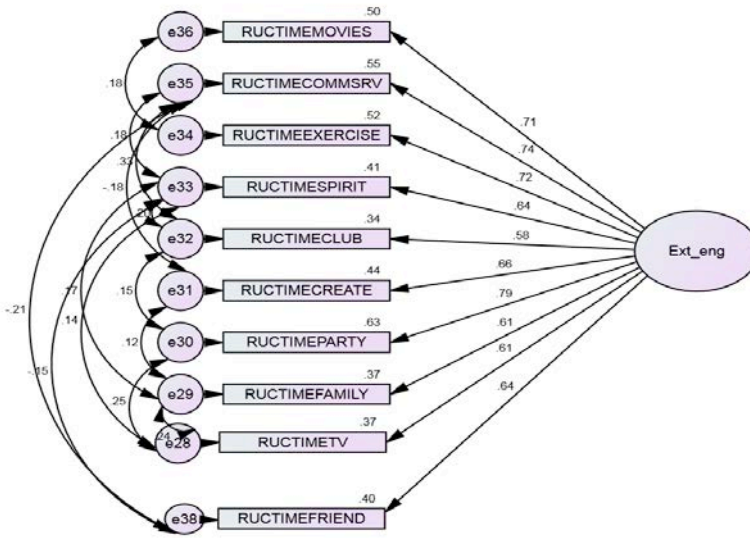

Figure 7: Measurement Model of the Extracurricular Engagement Latent Construct

Note. These indicators comprised the faculty-student interaction latent factor: RUCTIMEMOVIES (attending movies, concerts, sports, or other entertainment events), RUCTIMECOMMSRV (performing community service or volunteer activities), RUCTIMEEXERCISE (participating in physical exercise, recreational sports, or physically active hobbies and concepts derived from a course), RUCTIMESPIRIT (participating in spiritual or religious activities), RUCTIMECLUB (participating in student clubs or organizations), RUCTIMECREATE (pursuing a recreational or creative interest (arts/crafts, reading, music, hobbies, etc.), RUCTIMEPARTY (partying), RUCTIMEFAMIL (spending time with family), RUCTIMETV (watching TV), and RUCTIMEFRIEND (socializing with friends).

The second method for determining model fit of the hypothesized structural regression model was path analysis. This method explores the underlying relationships between the latent constructs and the structural model. This researcher removed and added paths and covariances until an acceptable structural regression model was constructed. The most notable direct paths to cognitive skills development were writing, faculty–student interaction, and elevated academic effort (see Figure 8). Because writing proficiency was the most significant predictor of cognitive skills development, direct paths from factors to writing proficiency are also included in Figure 8.

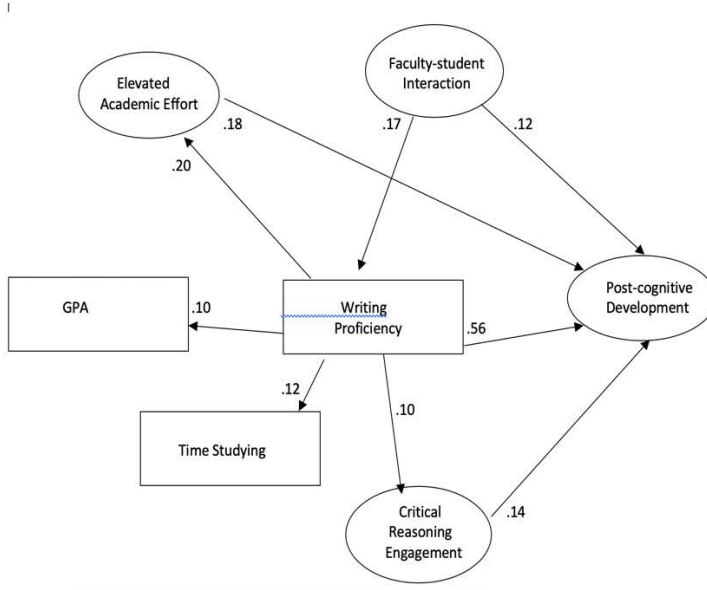

Figure 8: Direct Effects of Observed and Latent Variables on Postcognitive Development

Note. Also shown are the direct effects of writing proficiency on observed and latent variables.

Table 2: Model Fit Statistics for Confirmatory Factor Analyses

Model	χ^2 CMIN	*df*	*P*	CFI	RMSEA
Cognitive skills development: Precollege	4.60	2	.100	.998	.039
Cognitive skills development: Postcollege	3.37	2	.186	.999	.028
Critical reasoning engagement	6.57	4	.160	.999	.027
Elevated academic effort	6.73	5	.000	.993	.050
Faculty–student interaction	16.07	4	.241	.999	.020
Extracurricular engagement	29.96	22	.120	.988	.020

Note. CMIN= chi-square equivalent; CFI = comparative fit index; RMSEA = root mean square error of approximation.

Producing a structural regression model that satisfactorily addressed the research question regarding the contributions of background characteristics, precollege experiences, and current college experiences to cognitive skills development among international students attending highly selective universities resulted in many failures before structuring a model that exhibited excellent goodness-of-fit statistics. The resultant structural regression model reflected these statistics: (χ^2 = 1220.768 [*df* = 540, $p < .001$], PGFI (parsimony-adjusted goodness-of-fit index) = .751, PCFI (parsimony-adjusted comparative fit index) = .816, CFI (comparative fit index) = .952 [> .90 indicates good fit], RMSEA (root mean square error of approximation) = .038 [≤ .05 indicates good fit], CMIN/DF = 2.261 [relative χ^2: < 3.0 indicates good fit], and CAIC (consistent Akaike information criterion) = 2200.321). This structural regression model explained 57% of the total variance in cognitive skills development (see Appendix A). To evaluate the relationships among background characteristics, precollege experiences, college experiences, and cognitive skills development for international students attending highly selective institutions in California, the direct effects, indirect effects, and total effects of these variables were examined. Table 3 portrays the effects of these variables on cognitive skills development. Writing proficiency (standardized total effect = .638, $p < .001$) and elevated academic effort (standardized total effect = .139, $p = .001$) had the greatest impact upon the cognitive skills development among international students attending highly selective institutions.

Table 3: Direct, Indirect, and Total Effects of Latent and Observed Variables on Cognitive Skills Development

Variables	Direct effect	Indirect effect	Total effect
Time studying	0.090	0.049	0.139
First-generation status	0.062	0.054	0.116
High school GPA	0.000	0.043	0.043
Elevated academic effort	0.182	0.000	0.182

Variables	Direct effect	Indirect effect	Total effect
Critical reasoning engagement	0.143	0.000	0.143
Extracurricular engagement	−0.076	0.000	−0.076
Faculty–student interaction	0.117	0.000	0.117
Gender	−0.095	0.012	−0.083
Writing proficiency	0.559	0.079	0.638

The above statistical analyses have confirmed the existing literature that background characteristics, precollege experiences, and current college experiences do indeed impact the cognitive skills development among international students attending highly selected higher institutions in the United States. Of importance to note is that writing proficiency contributed significantly more than all of the remaining observed and latent variables to cognitive skills development combined (R^2 = .559).

DISCUSSION

This researcher sought to expand the understanding of higher education personnel of those factors that impact the cognitive skills development of international students. The comprehensive list of UCUES (2012) items associated with cognitive skills development has been included in Table 1. The following questions are the specific items that were associated with cognitive skills development: *Please rate your level of proficiency in the following when you started at this campus:*

(a) Analytical and critical thinking skills

(b) Ability to read and comprehend academic material

(c) Understanding of a specific field of study

(d) Ability to speak clearly and effectively in English.

Then, in either their junior or senior year, international students responded to these same questions regarding their current ability level of cognitive skills to determine the degree of growth.

Results from this study have indicated that background characteristics, precollege experiences, and current college experiences do, in fact, predict cognitive skills development among international students attending highly selective higher education institutions in the United States. However, this researcher cautions readers to note that this SEM was not causal but predictive of cognitive skills development.

Exploration of the background characteristics revealed the following contributions: gender difference had negligible (standardized total effect = −.084) impact on cognitive skills development, and first-generation status contributed to a slightly greater degree to the cognitive skills development (standardized total effect = .116).

The precollege contributions to cognitive skills development were more significant: Making a small contribution was high school grade point average (GPA; standardized total effect = .043), and predicting significantly more cognitive skills

growth was the writing proficiency (standardized total effect = .622) of this student group. A number of researchers have linked cognitive skills development, academic achievement, and GPA among domestic students (Astin, 1993; King, 2009; Pascarella & Terenzini, 2005); hence, one can assume that the associations of these variables among domestic students parallel the experiences of international students. Regarding precollege writing proficiency, I confirmed the findings of Andrade (2006), Li et al. (2009), and J.-C. Lin and Yi (1997) that this skill is linked closely to cognitive development and academic achievement.

Current college experiences were also predictive of the cognitive skills development of international students attending highly selective institutions in the United States. To determine the direct and indirect effects of these college experiences on cognitive skills development, I created four latent constructs, and I selected five observed variables from the UCUES, 2012 survey. Of the latent constructs, elevated academic effort predicted the greatest cognitive growth (R^2 = .182).

Critical reasoning engagement contributed significantly to cognitive skills development (total standardized effect = .143) as well. Because critical thinking and cognitive ability are closely related (Pascarella & Terenzini, 2005), this finding was not surprising. Even faculty–student interaction was a factor in cognitive skills development (standardized total effect = .117). Researchers have found that faculty–student interaction, academic achievement, and cognitive skills development are linked among domestic students (Terenzini et al., 1996; Wilson et al., 1974). Hence, one can justify this link among international students as well.

The latent construct extracurricular engagement affected cognitive skills development, albeit negatively (standardized total effect = −.076). Less cognitive growth seemed to occur among international students if they were overly involved in extracurricular activities. This finding conflicted with the research of others who have found extracurricular engagement to positively affect cognitive skills growth (Glass, 2012; Jaschik, 2012; Pascarella & Terenzini, 2005). One explanation might be the small percentage of international students who actually do participate in extracurricular activities.

Confirming the work of Heggins and Jackson (2003), the observable variable time studying was determined to be a contributor to cognitive skills development among international students attending highly selective institutions (standardized total effect = .139). Heggins and Jackson (2003) found that international students consider hard work and discipline as critical components of academic achievement.

Implications

The implications of this study contribute significantly to the understanding of higher education leaders about cognitive skills development among international students attending highly selective U.S. institutions. Most important is the acknowledgment of writing proficiency as the greatest predictor of academic achievement and cognitive skills development among international students. This finding confirmed the work of many other researchers (Martirosyan et al., 2015; Safipour et al., 2017).

A second significant finding was the relationship between English writing and high-level cognitive functions, thus confirming the findings of Zhang and Mi (2010) and Johnstone et al., (2002). International students must be proficient at planning, synthesizing, organizing, composing and revising their writing if they are to excel academically.

Furthermore, impacting the cognitive skills development of international students were the educational experiences with which these students enter U.S. higher education institutions. Critical reasoning had not been a part of the educational experiences of many international students (Zhang, 1999). For international students, straight lecture rather than an interactive pedagogy had been the mode of knowledge delivery (Zhang, 1999). Moreover, international students were not accustomed to thinking with complexity and valuing multiple perspectives (Glass, 2012). Because of these cognitive deficits, a third implication was the need to address these cognitive deficits.

The approaches below address cognitive deficits and foster cognitive skills development among international students coming to highly selective institutions in the United States. First, additional language support needs to be provided. Second, those individuals who interact with international students must be informed of the differences in international educational systems, pedagogical approaches, and learning styles. Third, opportunities to develop the critical thinking skills of international students in their classes must be provided, which benefits not only international students but also domestic students. Finally, additional experiences must be offered that can provide greater support, such as first-year seminars, informal mentoring, community activities, and out-of-class faculty–student interaction.

One final implication related to cognitive skills development is this: These skills grow slowly and steadily (King & Kitchener, 1994; Magolda, 1992; Perry, 1968, 1970, 1981). Hence, it is highly unlikely that equal cognitive ability between domestic and international students with the same academic characteristics will exist until first-year international students enter U.S. higher education institutions with these deficits eliminated. However, great strides can be made in cognitive skills development and academic satisfaction if American professors introduce challenging issues and provide immediate feedback so that cognitive growth can occur.

Limitations

Unfortunately, participants of the UCUES 2012 survey were not asked from which country they came. All analyses of the data conducted by the University of California President's Office grouped international students in the aggregate rather than as individuals coming from different countries with unique experiences and educational systems. As suggested by other researchers, the direct and indirect causal paths may differ among the latent constructs, observed variables, and cognitive skills development, depending on from which country and culture the international student came (Kim & Sax, 2009; J. J. Lee & Rice, 2007).

As with most research studies, other limitations surfaced. The statistical reliability of the research study was compromised because the findings were less robust for international students than they were for domestic students. This limitation

was confirmed in a similar study which was conducted using the data from the previous UCUES survey (2010). When one population is small in comparison to another population, statistical reliability is questionable (Kim et al., 2015).

A limitation of this research study is that the UCUES is only administered every 2 years. Yearly assessment of the international students' progress would have assisted higher education administrators in their efforts to provide the appropriate support and intensity of tutelage. Moreover, a more recent set of data might reflect that some supports have been provided for international students already. In addition, having a focus on only one component of academic achievement, cognitive skills development, is an additional limitation. Many factors encourage academic achievement and warrant more focus and exploration.

Still another limitation is the applicability of the findings to higher education institutions across the United States. Data collected by those individuals associated with a highly selective system of higher education research institutions on the West Coast resulted in the findings reported in this journal article. Therefore, those private U.S. higher education institutions with a teaching focus rather than a research focus may not reflect the same findings as this research study.

Yet another limitation was the survey instrument. The researcher determined what variables would be explored; other potential variables were disregarded. Surveys also depend on self-reported data. As Johnstone et al. (2002) aptly stated, "Cognitive processes . . . are inherently difficult to measure" (p. 305). Researchers have questioned whether or not students' responses can be trusted. Despite the validity and reliability of the UCUES 2012 survey items, international students' responses may be inaccurate.

Finally, even though journals such as this one have increased the understanding of higher education leaders of international students and their needs, this researcher found that focusing specifically on cognitive skills development was a component of academic achievement worthy of additional research attention.

Future Research

Because the number of international students entering the United States to complete their postsecondary education is rapidly growing, the need to explore those experiences that encourage academic achievement of this student population is critical. Most researchers have focused on the retention of international students or have directed their energies toward domestic students. Much more research needs to be conducted to identify those student supports that ensure a satisfactory educational experience in the United States. For most international students, academic achievement is their primary goal. The satisfaction of international students is contingent on their ability to accomplish their educational goals at their chosen U.S. higher education institutions. The responses on a UCUES 2012 item that asked whether or not the value of their education was worth the price that international students were paying should give cause for alarm among higher education officials. Over half of the 875 international students who responded to this item in this research study indicated some degree of dissatisfaction (*very dissatisfied* = 104; *dissatisfied* = 148; and *somewhat dissatisfied* = 226). If the stream of international students coming

to the United States to study at higher education institutions is to continue, then the reasons for this reported dissatisfaction among international students must be explored. Of interest to those individuals involved with higher education are the high educational goals of international students. Three careers were highly sought: 276 students were interested in business-related professions, 192 students hoped to enter engineering or computer programming fields, and 105 declared health-related professions as their ultimate goal. After completing their tertiary degree, only 44 international students had no intention of pursuing a graduate degree. Yet, one wonders why so many international students were dissatisfied with their overall GPA (360 students). More researchers should explore why international students are not satisfied with their college GPAs and determine what supports are needed to assist these struggling students.

Revealing still another reason for conducting additional research that identifies those experiences that lead to greater satisfaction of international students attending U.S. higher education institutions is the UCUES 2012 item that asked if students are satisfied with their overall academic experience. The responses were more encouraging on this item, for 710 students indicated that they were satisfied to some degree (65 = *very satisfied*; 343 = *satisfied*; 302 = *somewhat satisfied*). Extracurricular activities were experiences that impacted international student satisfaction and stimulated academic growth. Determining exactly which social activities contribute to positive educational experiences for international students would be helpful information for higher education leaders. As stated repeatedly above, academic achievement is the primary concern of international students attending U.S. higher education institutions.

A number of components comprise academic achievement. Not only should cognitive skills development be explored more thoroughly, but also such factors as critical reasoning engagement and writing proficiency should be examined in greater depth for their contribution to the academic success of international students. The findings of this researcher have indicated that these skills are critical to the attainment of international students' academic goals.

CONCLUSION

Recruiters representing their specific U.S. higher education institutions are actively encouraging international students all over the world to enroll at their universities. International students respond to this recruitment because tertiary degrees from prestigious universities in the United States are valued worldwide. Because international students are making their educational choices based on academic excellence, higher education leaders in the United States should exert every effort to ensure that international students excel academically and achieve their educational aspirations.

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