Article

Check for updates OPEN ACCESS

Journal of International Students
Volume 16, Issue 21 (2026), pp. 1-29
ISSN: 2162-3104 (Print), 2166-3750 (Online)
jistudents.org
DOI: https://doi.org/10.32674/yh89n034

Basic Psychological Needs Satisfaction, Acculturative Stress, and International Students' Adaptation: Evidence from Structural Equation Modeling

Sabrina Habbiche [1]*, László Kinyó [2], Saif Husam Mohammed [3]

[1]* Corresponding Author: Doctoral School of Education, University of Szeged, Szeged, Hungary; sabrina.habbiche@edu.u-szeged.hu
[2] Institute of Education, University of Szeged, Szeged, Hungary; kinyo.laszlo.02@szte.hu
[3] Directorate of Educational Research, Ministry of Education, Erbil, Kurdistan Region, Iraq; Mohammed.saif.husam@gmail.com

ABSTRACT

Previous research on international student adaptation has primarily focused on traditional study destinations, with limited attention to contexts such as Hungary. This study draws on Basic Psychological Needs Theory (BPNT) and acculturative stress theory to propose a dual-path model that examines relationships among basic psychological needs satisfaction (BPNS), acculturative stress (AS), and three adaptation outcomes: positive psychological adaptation, negative psychological adaptation, and sociocultural adaptation. A cross-sectional survey of 121 international students at the University of Szeged, Hungary, was analyzed using partial least squares structural equation modeling (PLS-SEM). BPNS and AS were modeled as reflective-formative higher-order constructs, while adaptation outcomes were specified as reflective constructs. The findings indicate that BPNS is negatively associated with acculturative stress ($\beta = -0.472$, $p < .001$) and positively associated with both positive psychological adaptation ($\beta = 0.368$, $p = .001$) and sociocultural adaptation ($\beta = 0.325$, $p = .001$). The specific indirect association between BPNS and negative psychological adaptation through acculturative stress is negative ($\beta = -0.313$, $p < .001$), whereas the direct association is nonsignificant. Acculturative stress is positively associated with negative psychological adaptation ($\beta = 0.674$, $p < .001$) and negatively associated with positive psychological adaptation ($\beta = -0.326$, $p = .001$) and sociocultural adaptation ($\beta = -0.385$, $p < .001$). These results differentiate adaptation outcomes in the Hungarian context and underscore practical implications for universities and mental health practitioners seeking to foster need-supportive environments and implement targeted stress-management interventions for international students.

Keywords: acculturative stress; basic psychological needs satisfaction; Hungary; international students; PLS-SEM; psychological adaptation; sociocultural adaptation

© Author(s), 2026. Published by Star Scholars Press.
This article is distributed under the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. https://creativecommons.org/licenses/by/4.0/

INTRODUCTION

Globalization and the internationalization of higher education have positioned international student mobility as a strategic element of global education (de Wit & Wang, 2025). Over recent decades, internationalization has evolved from an educational practice into a multidisciplinary research area encompassing institutional practices, geopolitical influences, and economic objectives (de Wit, 2024). In the 21st century, this evolution has been driven by increasing cross-border student mobility. Notably, the number of students pursuing higher education degrees abroad has more than tripled since 2000, rising from 2.1 million to approximately 6.9 million between 2000 and 2022 (UNESCO, 2025).

As internationalization continues to reshape how higher education is designed, delivered, and experienced by students worldwide (de Wit & Deca, 2020), it also represents a process of cultural formation through immersion in knowledge (Xiang, 2024). International student mobility is now seen as a multidimensional process where students are not solely passive participants in mobility flows. Instead, they actively take part in meaning-making, identity development, and managing academic, psychological, social, and cultural challenges (Torres-Arends et al., 2025). In this context, Hungary represents an important setting for examining adaptation, with international student enrollment reaching 32,000 in 2017, or 11.5% of all students (Kovács & Kasza, 2018).

Although earlier research examined international students' experiences from psychological, social, and mental health perspectives (Jing et al., 2020), these approaches have not consistently incorporated students' agency and well-being into explanatory models. Consequently, they often provide a descriptive account of adaptation that portrays students as passive recipients of change, rather than explaining how adaptation is experienced and negotiated (Deuchar, 2022). Recent studies have broadened this literature by exploring mental health, well-being, and related factors, though their models vary in predictors, mediators, and outcomes. For example, Ladum and Burkholder (2019) studied cultural distance, social support, acculturative stress, and psychological adaptation among international students in Northern Cyprus, but found no moderating effect of social support. Amlashi et al. (2025) examined the link between acculturative stress and psychological well-being through social support, emotion-regulation difficulties, and meaning-centered coping among international students in Germany. Neither study included BPNS or sociocultural adaptation in its model.

Although several conceptual models address stress and social integration, significant gaps remain in how adaptation is conceptualized and measured, which limits cumulative knowledge development (Yang & Du, 2025). Recent findings (Xu & Chai, 2025; Xu et al., 2026) highlight the expanding scope of adaptation research and the growing complexity of psychological and social factors affecting students' adjustment. These findings underscore the need for integrative models that explain how these processes interact.

Building on this perspective, this study suggests a dual-path explanatory model that integrates psychological resources and environmental risk factors to explain international students' adaptation. Accordingly, it addresses the following research questions:

1. To what extent does satisfaction of basic psychological needs predict psychological and sociocultural adaptation among international students?
2. To what extent does acculturative stress predict psychological and sociocultural adaptation?

3. How do basic psychological needs satisfaction and acculturative stress interact to explain international students' psychological and sociocultural adaptation outcomes?

Research on international student adaptation has given comparatively less attention to nontraditional destinations in Central and Eastern Europe, including Hungary (Németh et al., 2025). The primary contribution of this study is contextual, providing evidence from 121 international students at the University of Szeged, Hungary, with inference limited to this institutional sample. The theoretical contribution is an incremental empirical application of BPNT and acculturative stress theory, jointly examining BPNS and acculturative stress in relation to positive psychological adaptation, negative psychological adaptation, and sociocultural adaptation. This approach enables the reported associations to be considered separately across these three outcomes, but does not establish a new theory or causal mechanism. Methodologically, the study applies established PLS-SEM procedures, including reflective and formative measurement specifications and the disjoint two-stage approach, without introducing a new method.

LITERATURE REVIEW

The Hungarian Higher Education Context

Hungarian higher education underwent rapid internationalization since the late 1990s, primarily due to the Bologna reform process and the introduction of the Stipendium Hungaricum Scholarship in 2013 (Lannert & Derényi, 2020; Tong, 2020; Wang & Wang, 2022). Recent evidence indicates a persistent upward trend. In the 2007/2008 academic year, students from 118 countries were enrolled in Hungarian higher education institutions, and by 2011/2012, international students represented 5.6% of total university enrollment (Pusztai et al., 2016).

Research in Hungary identifies language and cultural barriers as primary challenges to social integration and students' sense of belonging (Tong, 2020). These challenges are also linked to institutional structures, including limited shared courses, insufficient joint activities, and the separation of domestic and international students in some academic contexts (Lannert & Derényi, 2020; Kovács & Kasza, 2018). Academic adjustment is also identified as a major challenge because of substantial differences between students' previous educational experiences and the Hungarian higher education system (Németh et al., 2025; Tong, 2020). Gebregergis and Csukonyi (2025b) found a positive association between sociocultural and psychological adaptation among international students at the University of Debrecen. In contrast, Malota and Mucsi (2025) identified negative associations between acculturative stress and both sociocultural adaptation and student satisfaction in a Hungary-based sample. Matavovszky et al. (2026) investigated psychological, sociocultural, and academic adaptation collectively, assessing psychological adaptation through depressive and anxiety symptoms. These studies address related aspects of adaptation but differ in their predictors and outcome definitions.

Basic Psychological Needs Satisfaction (BPNS)

Basic Psychological Needs Theory (BPNT), within Self-Determination Theory (SDT), links satisfaction of autonomy, competence, and relatedness with psychological growth and well-being (Vansteenkiste & Ryan, 2013; Deci & Ryan, 2000). The theory states that such satisfaction fosters proactive, prosocial, and growth-oriented behavior, leading to greater well-being and stronger interpersonal relationships (Leow et al., 2023). Conversely, need frustration is associated with ill-being, maladaptive coping strategies, compensatory need substitutes, and rigid behavioral patterns, but low need satisfaction does not necessarily imply frustration (Vansteenkiste et al., 2020; Vansteenkiste & Ryan, 2013). By definition, relatedness refers to the experience of connection with others, whereas competence reflects individuals' confidence in their abilities (Ryan & Deci, 2017). However, autonomy is arguably the hardest need to define because psychologists sometimes equate it with individualism and independence. Instead,

within SDT, autonomy refers to the experience of volition and the willingness to endorse one's actions (Chen et al., 2015; Chirkov et al., 2003).

Empirical evidence has consistently supported the universality of basic psychological needs across cultures while clarifying their boundary conditions, showing that the associations between need satisfaction and well-being remain largely consistent across several cultural settings, ages, genders, and social classes (Chen et al., 2015). However, research also demonstrates that environmental, cultural, and individual differences influence these needs, as universality does not imply uniformity (Ryan et al., 2025).

Although initial SDT-based research mainly focused on relationships between BPNS and motivation, subsequent studies expanded this focus to examine behavioral internalization (Vansteenkiste et al., 2018). More recently, research has grown increasingly sophisticated, yielding conceptual refinements and greater attention to moderating variables through more mechanistic explanatory models (Vansteenkiste et al., 2020; Xu & Shapii, 2025). Although the universal functionality of basic psychological needs is assumed, their value or salience may vary across individuals and contexts (Schürmann et al., 2022). Accordingly, recent studies have examined how these needs operate across complex settings and new cultural environments (Martela et al., 2023), highlighting the evolution of conceptual models from simple linear relationships to multidimensional and hierarchical frameworks.

Acculturative Stress as a Multidimensional Risk System

Acculturative stress is a specific form of stress that arises from the ongoing process of acculturation, which involves negotiating meaning and adapting to a new cultural environment (Berry, 2006). Acculturative stress emerges through continuous interactions among cultural and personal differences, institutional practices, academic expectations, and experiences of social inclusion or exclusion (Kristiana et al., 2022; Xu & Chai, 2025). Several psychological frameworks, including Lazarus and Folkman's stress and coping theory (Biggs et al., 2017) and the acculturation framework (Sam & Berry, 2010), have linked acculturative stress to broader adaptation processes, suggesting that intercultural demands trigger cognitive, emotional, and behavioral responses that shape students' adaptation outcomes.

However, the effects of acculturative stress vary across individuals (Torres-Arends et al., 2025) because not all acculturation experiences result in psychological stress. Instead, the extent to which acculturative stress is experienced and managed depends on both personal and environmental resources (Chen, 2025). This viewpoint suggests that acculturative stress is not a unitary construct but a multidimensional system of interrelated intrapersonal and interpersonal stressors (Zhang & Jung, 2017).

Within cross-cultural research, studies have examined the relationships among acculturative stress, adaptation outcomes, and mental health (Arshad et al., 2026). Findings consistently demonstrate that higher levels of acculturative stress are associated with poorer psychological and social adaptation, including mental health problems and difficulties related to social norms (Koo et al., 2021). Across diverse immigrant populations and acculturation contexts, individuals experiencing greater acculturative stress consistently exhibit more pronounced cognitive and emotional difficulties, resulting in poorer psychological and social outcomes (Choy et al., 2021). Supporting this conclusion, Lerias et al. (2025) found that acculturative stress remained a robust predictor of mental health across multiple ethnic groups and national contexts, despite variations in symptom presentation. More specifically, the evidence warrants outcome-specific interpretation. Çimşir and Ünlü Kaynakçı (2024) found a positive association between acculturative stress and depressive symptoms in a meta-analysis of international-student studies. These findings provide empirical grounds for H2–H4 while supporting separate consideration of distress, favorable psychological functioning, and sociocultural functioning.

Adaptation as a Multidimensional Outcome

Within acculturation research, adaptation is viewed as a multifaceted outcome of the acculturation process comprising two distinct dimensions: psychological adaptation and sociocultural adaptation (Berry, 1997). Sociocultural adaptation concerns managing everyday activities and interactions in the host environment (Searle & Ward, 1990) and is predicted by cultural knowledge, the extent of intercultural contact, and intergroup attitudes. Positive psychological adaptation is also associated with personality traits, life change events, and social support (Mahmood et al., 2026). In contrast, negative psychological adaptation has been linked to a higher incidence of life changes, loneliness, stress, and avoidant coping styles (Ward & Kennedy, 1999). Importantly, this distinction is empirically supported, with studies showing that positive and negative psychological adaptation are related yet distinct dimensions of psychological adaptation (Bethel et al., 2020; Hirai et al., 2015). Consequently, individuals may report positive psychological functioning while simultaneously experiencing difficulties with sociocultural adaptation. For example, distant emotional support-seeking was found to negatively predict psychological adaptation while alleviating feelings of loneliness, suggesting that individuals may experience emotional relief despite poorer psychological adjustment (Zheng & Ishii, 2023). Collectively, these findings indicate that adaptation isn't merely the absence of stress or a unidimensional process but rather a multidimensional outcome shaped by interacting psychological, social, and cultural factors (Wang et al., 2021).

Church et al. (2013) identified separate positive- and negative-emotion factors in questionnaire responses across cultural samples. Together with Ren and Jiang's (2021) separate examination of happiness and depression, this provides relevant precedent for examining favorable emotional functioning alongside distress. However, these studies used different measures and do not establish the validity of the adapted BPAS dimensions used in the present study. Psychological adaptation concerns favorable and adverse emotional responses to living in the host culture (Ladum & Burkholder, 2019). In the present study, we examine these responses separately as positive psychological adaptation (PPA), negative psychological adaptation (NPA), and sociocultural adaptation (SCA). The three outcomes therefore address different questions: whether students experience favorable emotions, whether they experience emotional difficulties, and how they manage practical demands in the host environment. Examining them separately allows the study to assess whether BPNS and acculturative stress show distinct patterns of association across these aspects of adaptation.

HYPOTHESES DEVELOPMENT AND CONCEPTUAL MODEL

Building on the previous literature and identified research gaps, the present study proposes a dual-path conceptual model (Figure 1) in which psychological resources and environmental stressors are examined as concurrent predictors of three adaptation outcomes at the University of Szeged. BPNS is conceptualized as a psychological resource (Vansteenkiste & Ryan, 2013), while acculturative stress is treated as a multidimensional stress response expected to be associated with poorer adaptation (Malota & Mucsi, 2025).

Previous studies link BPNS to culture shock and subjective well-being (Yang et al., 2018) and acculturative stress to sociocultural adaptation in Hungary (Malota & Mucsi, 2025). The present model brings these relationships together while examining positive and negative psychological adaptation separately. In the present model, acculturative stress is specified as both an intermediate variable in the proposed indirect pathways from BPNS and a statistical predictor of adaptation, consistent with its distinction as a response of psychological adaptation (Ladum & Burkholder, 2019).

Figure 1 specifies a negative association between BPNS and acculturative stress, and separate paths from each construct to each adaptation outcome. Including both predictors allows examination of whether BPNS is associated with each outcome when acculturative stress is also considered, alongside the proposed indirect associations through stress. The contribution is a focused contextual examination of recognized

theoretical expectations; therefore, the specified paths do not establish temporal ordering or causal mechanisms. Accordingly, the following hypotheses are proposed:

H1: BPNS is negatively associated with acculturative stress.

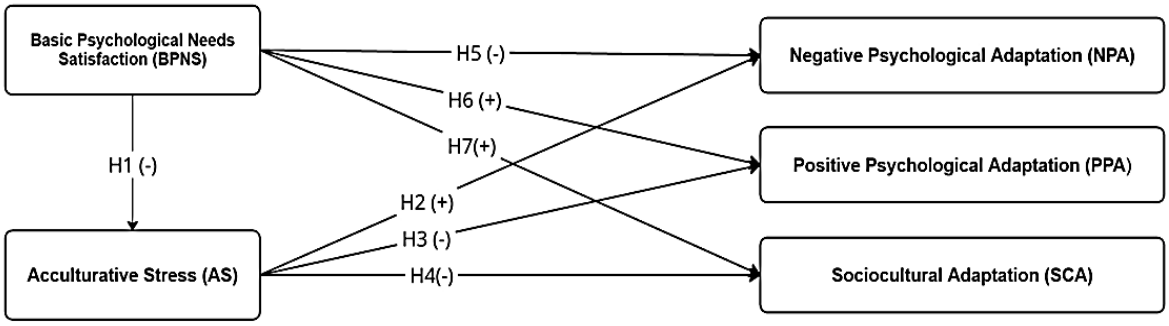
H2: Acculturative stress is positively associated with negative psychological adaptation.

H3: Acculturative stress is negatively associated with positive psychological adaptation.

H4: Acculturative stress is negatively associated with sociocultural adaptation.

Figure 1

Proposed Model of BPNS, Acculturative Stress, and International Student Adaptation



For H5, need satisfaction may support resources for coping with difficult experiences. In a student sample, autonomy, competence, and relatedness satisfaction each correlated negatively with anxiety–depression scores (Longo et al., 2016). Ren and Jiang (2021) found a negative association between need satisfaction and depression in a model that also included acculturation stress and need frustration. Their findings therefore provide qualified support for examining whether BPNS remains negatively associated with adverse emotional adjustment when acculturative stress is included in the present model.

H5: BPNS is negatively associated with negative psychological adaptation.

H6 concerns favorable emotional adjustment as an outcome in its own right. Among international students studying in the United States, Yang et al. (2018) found that greater BPNS was associated with higher subjective well-being; however, because their subjective well-being outcome combined life satisfaction, positive affect, and negative affect, that composite does not isolate favorable responses to living in the host culture. H6 therefore examines whether BPNS is positively associated with these favorable responses when acculturative stress is considered concurrently.

H6: BPNS is positively associated with positive psychological adaptation.

H7 concerns practical engagement with the host environment. On this basis, we propose that satisfying these needs may support willingness to engage with unfamiliar situations and the perceived capacity to manage social interactions. This reasoning motivates a positive association with sociocultural adaptation, while recognizing that need satisfaction and acquired cultural knowledge are distinct (Gebregergis & Csukonyi, 2025a). However, the cited evidence does not directly test this BPNS–sociocultural adaptation path.

H7: BPNS is positively associated with sociocultural adaptation.

RESEARCH METHOD

Participants and Procedure

This study employed a quantitative, cross-sectional, explanatory research design using convenience sampling to recruit participants. Data were collected through an online questionnaire distributed via WhatsApp groups and the International Office at the University of Szeged, Hungary. Ethical approval was

obtained from the Research Ethics Committee at the authors' institution. The final sample comprised 121 international students enrolled at the University of Szeged, Hungary. Participants had a mean age of 24 years (SD = 5.33), and their demographic characteristics are presented in Table 1.

Table 1

Characteristic	Category	n (%)
Gender	Female	73 (60.3)
	Male	48 (39.7)
Age group	18–21	51 (42.1)
	22–26	29 (24.0)
	27–35	41 (33.9)
Region of origin	Asia	68 (56.2)
	Africa	36 (29.8)
	Europe	11 (9.1)
	Americas	6 (4.9)
Degree level	Bachelor's	51 (42.1)
	Master's	35 (28.9)
	Doctoral	35 (28.9)
Length of residence	< 1 year	39 (32.2)
	1–3 years	53 (43.8)
	> 3 years	29 (24.0)
Prior international experience	None	58 (47.9)

Demographic Characteristics of Participants
Note. N = 121.

Instruments

Before completing the main questionnaire, participants reviewed the informed consent form, then completed a sociodemographic questionnaire. All study constructs were measured using multi-item scales adapted from previously validated instruments. All measures used seven response points, but their anchors differed: basic psychological needs, acculturative stress, and psychological adaptation used agreement anchors, whereas sociocultural adaptation ranged from "Did not adapt" to "Fully adapted.

Basic Psychological Needs Satisfaction Scale (BPNSS): Several modified versions of the original scale have been developed to assess basic psychological needs throughout different life domains. In this study, the BPNSS was used to assess students' general psychological need satisfaction (Deci & Ryan, 2000; Gagné, 2003). The scale consists of 21 items, including 10 reverse-coded items. It measures three dimensions: autonomy (7 items), competence (6 items), and relatedness (8 items).

Acculturative Stress Scale for International Students (ASSIS): This scale assesses acculturative stress during cross-cultural adaptation (Sandhu & Asrabadi, 1994). It consists of 36 items representing seven dimensions: perceived discrimination, homesickness, perceived hate, fear, stress due to change/culture shock, guilt, and miscellaneous stressors. The original scale used a 5-point Likert scale. However, the response format was adapted to a 7-point Likert scale to sustain consistency across all study measures.

Brief Psychological Adaptation Scale (BPAS) and Brief Sociocultural Adaptation Scale (BSAS): Both scales use a 7-point Likert scale to assess two dimensions of cross-cultural adaptation (Demes

& Geeraert, 2014). The BPAS evaluates individuals' emotional and psychological adjustment to a new cultural environment. The BPAS final version consists of 8 items; In this study, the broader 10-item pool was adapted to distinguish positive and negative psychological adaptation. This choice was intended to provide broader coverage of the positive dimension, which a limited number of indicators would have otherwise represented. In contrast, the BSAS assesses the behavioral and social aspects of adaptation, including individuals' familiarity with cultural norms and ability to navigate everyday social and cultural situations.

Data Analysis

Data analysis was conducted using SmartPLS 3.0 and 4.0 (Ringle et al., 2015, 2024) with a two-step approach that assessed the measurement and structural models. First, the lower- and higher-order measurement models were evaluated to assess construct reliability and validity, followed by evaluation of the structural model and hypothesis testing. Partial least squares structural equation modeling (PLS-SEM) was selected because it accommodates both reflective and formative constructs and can simultaneously estimate complex theoretical models (Sarstedt et al., 2022). As a variance-based structural equation modeling approach, PLS-SEM is particularly suitable for research focused on explaining variance in endogenous latent constructs and evaluating complex relationships among multiple constructs within an integrated model (Goodhue et al., 2012; Hair et al., 2022). SPSS version 27 was used to compute descriptive statistics and assess common method bias.

Sample size was assessed retrospectively using a planning-style benchmark in G*Power 3.1.9.7 (Faul et al., 2009). The fixed-model multiple-regression F test for R^2 deviation from zero, with two predictors, an assumed overall effect size of $f^2 = 0.15$, $\alpha = .05$, and target power of .80, indicated a minimum sample size of 68. The two predictors were BPNS and acculturative stress for each adaptation outcome. A complementary inverse-square-root assessment used the smallest statistically significant structural coefficient in absolute magnitude (acculturative stress to positive psychological adaptation; $\beta = -.328$). Under the original one-tailed $\alpha = .05$ convention and target power of .80, the calculation indicated a minimum of 58 observations (Kock & Hadaya, 2018). The final sample of 121 exceeded the sample-size benchmarks obtained under these assumptions. Calculation details are provided in Supplementary Table S1.

Updated structural inference used the selected SmartPLS 4 bootstrap with 5,000 samples, one-tailed testing at $\alpha = .05$, bias-corrected and accelerated (BCa) intervals, and a fixed seed. The exported 5% and 95% endpoint pairs are reported as 90% BCa intervals. Final-stage SRMR, R^2, and f^2 were obtained from the SmartPLS 4 second-stage algorithm output. Blindfolding cross-validated redundancy (Q^2) was obtained in SmartPLS 3 with an omission distance of 7 and interpreted for the reflective adaptation outcomes (Hair et al., 2017). PLSpredict assessed the supplied second-stage model in SmartPLS 4 using 10 folds, 10 repetitions, the Early antecedents setting, and a fixed seed. Q^2predict and indicator-level RMSE/MAE comparisons with the linear-model benchmark were examined separately from in-sample explanatory performance (Hair et al., 2019).

RESULTS

Validating the First-Order Measurement Model

In the first stage, the reflective first-order measurement model was evaluated by assessing indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. All first-order constructs were specified as reflective. Composite reliability (CR) values greater than 0.70 and average variance extracted (AVE) values greater than 0.50 indicate satisfactory reliability and convergent validity (Ali et al., 2018). Nevertheless, indicator loadings between 0.50 and 0.70 are considered acceptable when

the recommended thresholds for CR and AVE are satisfied (Hair et al., 2022). As shown in Supplementary Table S2, most retained indicators exhibited outer loadings above 0.50, indicating acceptable indicator reliability following the initial measurement model refinement.

Cronbach's alpha values exceeded the recommended threshold of 0.70 for all constructs, except autonomy ($\alpha = 0.657$). However, this value was considered acceptable based on prior validation studies, which recognize the complexity and context sensitivity of the autonomy construct (Cromhout et al., 2018; Sheldon & Hilpert, 2012; Taber, 2018). Moreover, we did not interpret Cronbach's alpha in isolation but alongside CR and AVE, which provide more robust assessments of construct reliability and validity in PLS-SEM (Hair et al., 2022).

As presented in Supplementary Table S3, the initial AVE values for the six constructs were below the 0.50 threshold, indicating insufficient convergent validity. Consequently, we refined the measurement model by removing selected indicators with outer loadings between 0.40 and 0.70 when their removal improved both AVE and CR (Hair et al., 2022). This refinement increased the AVE values for autonomy, competence, relatedness, miscellaneous, negative psychological adaptation, and sociocultural adaptation. The final retained indicator structure and first-stage outer loadings are reported in Supplementary Table S2. After deleting items, all first-order constructs exceeded the recommended AVE threshold of 0.50 (Supplementary Table S3), while CR values ranged from 0.796 to 0.940, surpassing the recommended criterion of 0.70 (Supplementary Table S4). Discriminant validity was subsequently assessed using the heterotrait-monotrait ratio of correlations (HTMT; Supplementary Table S5, Panel A). Moreover, Supplementary Table S4 also reports the first-stage Fornell–Larcker assessment, with square roots of AVE for negative psychological adaptation (0.752), positive psychological adaptation (0.750), and sociocultural adaptation (0.722). The before- and after-deletion AVE estimates in Supplementary Table S3 are reported separately and should not be treated as interchangeable.

Validating the Second-Order Measurement Model

Basic psychological needs satisfaction (BPNS) and acculturative stress (AS) were modeled as second-order formative constructs using the disjoint two-stage approach and evaluated according to the guidelines for formative measurement models in PLS-SEM. This hierarchical component modeling approach estimates the lower-order constructs in the first stage. Then it uses their latent variable scores as indicators of the higher-order constructs in the second stage, resulting in more stable parameter estimates and reducing potential estimation bias within PLS-SEM (Hair et al., 2022).

First, multicollinearity among the lower-order dimension scores used as formative indicators within each higher-order construct was assessed using VIF values. The outer-model VIF values ranged from 1.096 to 4.149 and were below the threshold of 5 used in this assessment. Next, the significance and relevance of the formative indicators were evaluated by examining outer weights obtained through bootstrapping. For indicators with nonsignificant outer weights, retention was based on the magnitude and significance of the outer loading, together with theoretical coverage (Hair et al., 2017, 2019). The corresponding outer loadings are 0.834 for relatedness, 0.853 for autonomy, and 0.502 for competence. Competence's unrounded loading was only marginally above .50. Its outer weight was positive and significant under the specified one-tailed test (weight = .273, $p = .044$), providing statistical support alongside its theoretical importance as a core dimension of basic psychological needs satisfaction.

The outer weights indicate the relative contribution of each lower-order dimension to its respective higher-order construct. For the acculturative stress construct, cultural shock and homesickness exhibited the strongest contributions. Fear and guilt had nonsignificant outer weights ($p = .301$ and $p = .413$, respectively), but their outer loadings were .514 and .559 and were significant (both $p < .001$). Their retention was supported by the loading evidence and their theoretical coverage of acculturative stress (Hair et al., 2017, 2019). Fear's loading was only slightly above .50. For the BPNS construct, relatedness and autonomy contributed more strongly to the higher-order construct than competence. Overall, these findings

provide evidence supporting aspects of the validity of the specified higher-order measurement models in this sample, particularly the assessment of indicator collinearity and the contributions of their dimensions (Supplementary Table S6).

Discriminant validity among the reflective constructs was assessed using the Fornell-Larcker criterion, which compares the square root of each construct's AVE with the absolute values of its correlations with the other reflective constructs (Hair et al., 2022). As shown in Supplementary Table S7, the square root of the AVE for NPA (0.751), PPA (0.746), and SCA (0.722) exceeded the absolute values of their respective inter-construct correlations, indicating satisfactory discriminant validity. For example, the square root of the AVE for NPA (0.751) was greater than the absolute values of its correlations with AS (0.660), BPNS (−0.283), PPA (−0.218), and SCA (−0.434). The same pattern was observed for PPA and SCA, additionally supporting the discriminant validity of the reflective constructs. HTMT results for the three reflective adaptation outcomes in the second-stage model are reported in Supplementary Table S5, Panel B.

The unrotated principal components analysis in SPSS used the 60 indicators retained in the final first-order measurement model. The analysis included the reverse-scored competence indicators and used the correlation matrix, listwise deletion, and an eigenvalue-greater-than-one extraction criterion. All 121 participants had complete data for these indicators. The first unrotated component had an eigenvalue of 17.463 and explained 29.105% of total variance. Fifteen components had eigenvalues greater than one and together explained 75.262%. No single component accounted for most of the variance in this analysis (Supplementary Table S8).

Results of the Structural Model

Table 2 presents the direct and specific indirect structural associations. Six of seven hypotheses were supported, while one was not. Basic psychological needs satisfaction and acculturative stress jointly explained 37.2% of the variance in sociocultural adaptation, 35.5% of the variance in positive psychological adaptation, and 43.3% of the variance in negative psychological adaptation. In addition, basic psychological needs satisfaction explained 22.3% of the variance in acculturative stress. These R^2 values describe in-sample explanatory performance; their interpretation depends on the outcomes and research context rather than universal classifications (Hair et al., 2017, 2019).

The effect size (f^2) was evaluated using Cohen's (2013) guidelines, in which values of 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively. Beyond these reference points, f^2 describes each predictor's incremental explanatory contribution within the fitted model (Hair et al., 2017). Acculturative stress contributed most strongly to negative psychological adaptation (0.631), followed by sociocultural adaptation (0.182) and positive psychological adaptation (0.130). Basic psychological needs satisfaction explained acculturative stress (0.275), positive psychological adaptation (0.164), and sociocultural adaptation (0.134), with a negligible incremental direct contribution to negative psychological adaptation (0.001).

The second-stage SmartPLS 4 algorithm indicated SRMR values of 0.0968 for the saturated model and 0.0989 for the estimated model. Both exceeded .08 but remained below .10 at full precision; the estimated-model value was close to the latter boundary. Fit thresholds require cautious interpretation in PLS-SEM because its estimation objective differs from covariance-based model fitting and the applicability of global fit criteria remains debated (Hair et al., 2017, 2019). SRMR was therefore interpreted alongside the measurement, explanatory, and predictive assessments. The observed values did not meet the stricter .08 guideline, and their proximity to .10 warrants caution rather than an unqualified conclusion of satisfactory fit (Supplementary Table S9).

Blindfolding cross-validated redundancy Q^2 values were 0.219 for negative psychological adaptation, 0.170 for positive psychological adaptation, and 0.172 for sociocultural adaptation. All three exceeded zero, supporting predictive relevance for the reflective adaptation outcomes under this sample-

reuse procedure (Hair et al., 2017). Negative psychological adaptation had the highest Q^2. These results are distinct from PLSpredict Q^2predict and are summarized in Supplementary Table S9.

PLSpredict yielded positive construct-level Q^2predict values for acculturative stress (0.135), negative psychological adaptation (0.055), positive psychological adaptation (0.226), and sociocultural adaptation (0.210). Thirteen of the 14 adaptation indicators also had positive Q^2predict. Improvement over the linear-model benchmark varied across outcomes, with lower PLS RMSE for 0/4 negative-adaptation indicators, 1/4 positive-adaptation indicators, and 3/6 sociocultural-adaptation indicators. Supplementary Table S9 reports the corresponding MAE comparisons and counts of indicators with positive Q^2predict. These findings indicate positive mean-benchmark performance for most adaptation indicators, alongside uneven improvement over the linear-model benchmark. PLSpredict assessed the supplied second-stage model using repeated cross-validation conditional on previously generated construct scores.

Specific indirect associations through acculturative stress were negative for negative psychological adaptation ($\beta = -0.313$, $p < .001$) and positive for positive psychological adaptation ($\beta = 0.152$, $p = .007$) and sociocultural adaptation ($\beta = 0.178$, $p = .002$). All three 90% BCa intervals excluded zero (Table 2, Panel B). For negative psychological adaptation, the significant indirect association and nonsignificant direct association are consistent with indirect-only statistical mediation (Hair et al., 2017; Zhao et al., 2010).

Table 2

Direct and Specific Indirect Associations

Panel A. Direct Structural Associations.

H	Direct Effect	β	90% BCa CI	*t- value*	*p values*	Supported
H1	BPNS → AS	-0.472	(-0.552, -0.235)	5.703	< .001	Yes
H2	AS → NPA	0.674	(0.475, 0.787)	7.412	< .001	Yes
H3	AS → PPA	-0.326	(-0.474, -0.142)	3.284	.001	Yes
H4	AS → SCA	-0.385	(-0.523, -0.185)	3.774	< .001	Yes
H5	BPNS → NPA	0.034	(-0.174, 0.191)	0.266	.378	No
H6	BPNS → PPA	0.368	(0.167, 0.552)	3.092	.001	Yes
H7	BPNS → SCA	0.325	(0.140, 0.492)	3.013	.001	Yes

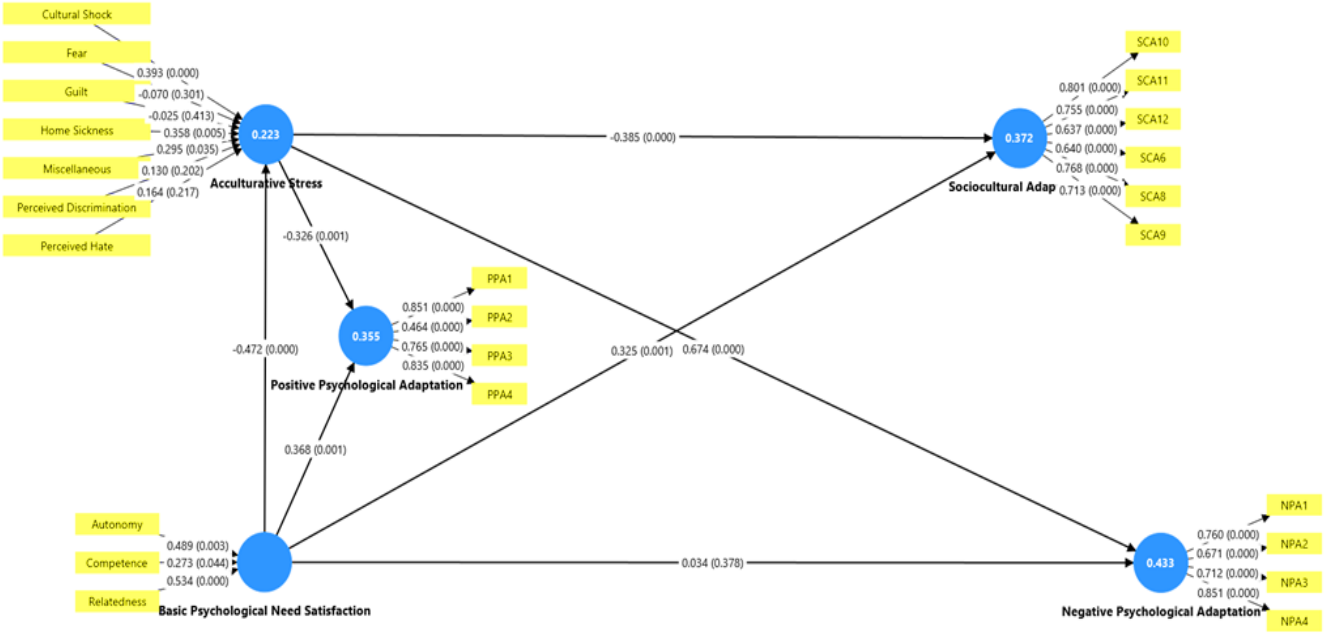
Panel B. Specific Indirect Associations.

Indirect pathway	β	90% BCa CI	t	p
BPNS → AS → NPA	-0.313	(-0.395, -0.166)	4.647	< .001
BPNS → AS → PPA	0.152	(0.045, 0.237)	2.460	.007
BPNS → AS → SCA	0.178	(0.068, 0.256)	2.928	.002

Note. BPNS = basic psychological needs satisfaction; AS = acculturative stress; NPA = negative psychological adaptation; PPA = positive psychological adaptation; SCA = sociocultural adaptation.

Figure 2

Results of the assessment of the structural model



Note. Numbers inside endogenous constructs indicate R^2 values. Structural paths show standardized coefficients; formative indicators show outer weights, and reflective indicators show second-stage outer loadings. First-stage loadings are reported in Supplementary Table S2.

DISCUSSION

Basic Psychological Needs as a Protective Resource

In the present model, BPNS was negatively associated with acculturative stress and positively associated with both positive psychological adaptation and sociocultural adaptation. Although the direct association with negative psychological adaptation was not significant, the specific indirect-effect analysis supports an indirect association through acculturative stress.

Additionally, the formative weight structure of the BPNS construct provides further substantive insight. The results indicate that autonomy (0.489) and relatedness (0.534) contributed more strongly than competence (0.273) to the higher-order construct. This finding is consistent with cross-cultural adaptation research demonstrating the importance of autonomy and relatedness across both Western and Eastern contexts. In contrast, competence support tends to be more culturally variable (Nalipay et al., 2020). One possible explanation is that competence may be less distinctive because students likely developed a sense of academic competence before their cultural transition. Autonomy and social relatedness are context-dependent and often need to be reconstructed within a new cultural environment. Consistent with this interpretation, Ryan et al. (2025) emphasized the importance of autonomy-supportive educational environments for students navigating cultural differences.

From a practical standpoint, the differential weighting also carries practical significance. Students who feel more self-directed, capable, and connected are better equipped to manage the demands of the host environment. Thus, psychological resources do not simply lead to better adjustment. Rather, they appear to strengthen students' capacity for self-regulation and coping with the challenges of intercultural transitions. Collectively, these findings reinforce the role of BPNS in fostering successful adaptation among

international students. This interpretation is consistent with previous research linking BPNS to better adaptation, enhanced well-being, and stronger academic and social integration (Carmona-Halty et al., 2019; González-Arias et al., 2025; Leow et al., 2023; Ren & Jiang, 2021).

Acculturative Stress and Adaptation Outcomes

Acculturative stress showed its strongest association with negative psychological adaptation and was negatively associated with positive psychological adaptation and sociocultural adaptation. The differences in the reported effect sizes across these outcomes illustrate the value of examining psychological and sociocultural adaptation separately. Psychological adjustment has been examined within a stress-and-coping framework, whereas sociocultural adjustment has been examined through social learning and the acquisition of culturally appropriate skills (Searle & Ward, 1990). Among international students in Germany, higher acculturative stress was associated with greater difficulties in emotion regulation, which were in turn associated with lower psychological well-being (Amlashi et al., 2025).

Acculturative stress made its largest incremental explanatory contribution to negative psychological adaptation, whereas BPNS made larger incremental contributions to positive psychological and sociocultural adaptation than to negative psychological adaptation. The model explained 43.3% of the in-sample variance in negative psychological adaptation. Still, its construct-level Q^2predict was 0.055, and neither PLS RMSE nor MAE was lower than the linear-model benchmark for any of its four indicators. This difference reflects the distinct purposes of explanatory and predictive assessment: explaining variation within the observed sample does not guarantee comparable improvement in predicting held-out observations (Hair et al., 2019).

These findings align with research on international students from Hungary. For example, Malota and Mucsi (2025) reported that lower levels of acculturative stress were associated with a greater likelihood of culturally appropriate idea expression, more accurate interpretation of locals' responses, improved collaboration with peers, better academic performance, and stronger personal and community-based relationships. Similarly, Németh et al. (2025) found that 34.1% of students reported social isolation, and 65.6% reported little or no interaction with Hungarian peers outside the classroom.

Beyond the structural paths, the formative outer weights reveal a clear hierarchy, with cultural shock (0.393) and homesickness (0.358) contributing more strongly to the higher-order construct than fear and guilt. These findings suggest that acculturative stress among international students is driven more by social disconnection, unfamiliarity with the host environment, and difficulties establishing relationships with local peers than by feelings of fear or guilt. This interpretation is consistent with previous studies conducted across diverse international student populations (e.g., Gyasi-Gyamerah et al., 2025).

Taken together, the model positions acculturative stress as both a predictor of adaptation outcomes and an intermediate variable between BPNS and adaptation. The direct path from BPNS to negative psychological adaptation was nonsignificant, while the specific indirect path through acculturative stress was significant. Therefore, acculturative stress should not be viewed merely as a challenge of adjustment but as a central pathway through which BPNS is associated with cross-cultural adaptation.

IMPLICATIONS

The findings contribute contextual evidence on the application of BPNT to adaptation among the sampled international students at the University of Szeged. The practical contribution of this study is to inform policymakers and educational institutions about approaches worth evaluating to support international students' adaptation. Findings regarding BPNS provide a rationale for examining need-supportive environments. The statistical mediating role of acculturative stress also motivates evaluating approaches that combine psychological need support with support for managing acculturative stress. Given the multifaceted nature of adaptation, universities should design programs that support autonomous

learning, develop competence, and strengthen interpersonal connections, for example, through cultural mentorship programs and mixed peer-learning groups. In this context, Kovács and Kasza (2018) specifically emphasized the importance of inclusive events and extracurricular programs that promote interaction between Hungarian and international students. Consequently, university counseling services should adopt context-sensitive approaches that prioritize psychoeducational programs and targeted mental health support.

LIMITATIONS

Despite its contributions, this study has several limitations that should be acknowledged. The cross-sectional design does not establish temporal ordering or causal relationships. Indirect effects should be interpreted as associations aligned with the proposed model rather than as evidence of causal mediation. Cross-sectional mediation estimates may differ substantially from the longitudinal processes they are intended to represent (Maxwell & Cole, 2007). Reliance on self-reported data collected at a single time point introduces the possibility of common-method and response bias. Although the unrotated principal components analysis did not reveal a dominant first component, method effects cannot be ruled out (Podsakoff et al., 2003).

The relatively small convenience sample from one university limits generalizability. Although the sample exceeded the conditional sample-size benchmarks, sensitivity to smaller relationships, including the direct BPNS–negative psychological adaptation path ($\beta = .034$), may have been limited. Recruitment through WhatsApp groups and the International Office may have favored students who were easier to reach or more willing to respond.

Cultural heterogeneity within this geographically diverse sample may also be obscured by pooled estimates, which do not establish measurement equivalence across cultural groups. Gender and previous overseas experience were recorded but were not included as controls, and the available region-of-origin and educational-level information does not establish country of origin or field of study. Consequently, the associations cannot be interpreted as relationships independent of these background differences. Language proficiency and funding were also not accounted for in the model. Although Hungarian-language proficiency was recorded, it does not establish proficiency in the language of instruction or comprehension of the questionnaire. Language-related differences in responses and adaptation therefore cannot be excluded. Scholarship status was not included, leaving potential differences in stress and adaptation unexamined. Similarly, the study did not examine contextual factors, including university policies, social support programs, and existing counseling services, which may influence students' adaptation experiences and stress levels.

The measures were adapted through item selection and changes to response formats; for psychological adaptation, separate positive and negative specifications were used. Selecting items from published instruments provides a conceptual foundation, and CR, AVE, and HTMT statistics describe the performance of the retained indicators in this sample. However, these statistics do not confirm that the shortened measures cover every relevant aspect of the constructs, are interpreted as intended by participants, or are equivalent to the original instruments or across cultural groups. Because items were selected and evaluated within the same sample, observed improvements in measurement statistics may be sample-dependent, and item removal may have reduced content coverage. Independent evaluation of the retained measures is necessary. The study does not include independent expert-panel ratings, respondent cognitive interviews, measurement-invariance testing, or redundancy assessment against an independent global criterion for the higher-order composites. Additionally, model fit and predictive validity were limited: SRMR exceeded conventional guidelines, and out-of-sample prediction for negative psychological adaptation was weak ($Q^2predict = 0.055$).

CONCLUSION

This study examines a dual-path model of international students' adaptation through the interplay between BPNS and acculturative stress. It was conducted among international students at the University of Szeged, Hungary, and adds contextual evidence by examining positive psychological adaptation, negative psychological adaptation, and sociocultural adaptation within the same model.

The findings indicate that BPNS is negatively associated with acculturative stress and positively associated with positive psychological and sociocultural adaptation. Needs satisfaction also showed an indirect association with adaptation outcomes through acculturative stress. Among the three psychological needs, relatedness and autonomy demonstrated larger formative weights than competence in the higher-order BPNS construct in this sample. Acculturative stress was associated with adaptation outcomes, and homesickness and cultural shock demonstrated the largest formative weights among its dimensions. This highlights the importance of meaningful social connections and cultural familiarity in supporting students' adjustment. Specifically, higher levels of acculturative stress were associated with lower levels of positive psychological and social functioning.

BPNS had a significant indirect association with negative psychological adaptation through acculturative stress, whereas the direct path was not statistically significant. This represents a statistical indirect-only mediation pattern within the specified model and does not establish that psychological resources reduce negative adaptation outcomes by reducing acculturative stress.

Author Contributions: Conceptualization was done by S.H. and S.H.M.; Data collection was done by S.H.; Methodology, software analysis, and validation were done by S.H. and S.H.M.; Findings and final analysis were discussed and finalized by S.H. and S.H.M.; writing—original draft preparation, S.H.; writing—final review and editing, S.H. and S.H.M.; supervision, L.K. All authors have read and agreed to the published version of the manuscript

Funding: This research was funded by the University of Szeged Open Access Fund, Grant ID: 8966.

Data Availability Statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request; they are not publicly available due to privacy and ethical restrictions concerning the participants.

Institutional Review Board Statement: Ethical approval was obtained from the University of Szeged Institutional Review Board (No. 11/2025). The study follows research ethics principles for research involving human participants. Before completing the questionnaire, participants reviewed an informed consent statement indicating the study's purpose, voluntary participation, anonymity, confidentiality, and their right to withdraw at any time.

Acknowledgments: During the preparation of this work, the authors used ChatGPT (OpenAI) and Grammarly for language refinement and formatting. The authors reviewed all output and remain responsible for the article's content and accuracy.

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the study design, data collection, analysis and interpretation, manuscript preparation, or the decision to publish the results.

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). The publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

REFERENCES

Ali, F., Rasoolimanesh, S. M., Sarstedt, M., Ringle, C. M., & Ryu, K. (2018). An assessment of the use of partial least squares structural equation modeling (PLS-SEM) in hospitality research. *International Journal of Contemporary Hospitality Management*, *30*(1), 514–538. https://doi.org/10.1108/IJCHM-10-2016-0568

Amlashi, R. S., Majzoobi, M. R., & Forstmeier, S. (2025). Acculturative stress and psychological well-being: The mediating role of social support, difficulties in emotion regulation, and meaning-centered coping style among international students in Germany. *International Journal of Intercultural Relations*, *108*, Article 102272. https://doi.org/10.1016/j.ijintrel.2025.102272

Arshad, F., Iqbal, H., Parveen, T., Riaz, M. N., Riaz, M. A., & Bashir, T. (2026). Acculturative stress and psychological well-being of international students: Role of social support and coping strategies. *Journal of International Students*, *16*(16), 19–44. https://doi.org/10.32674/8gakzw80

Berry, J. W. (1997). Immigration, acculturation, and adaptation. *Applied Psychology*, *46*(1), 5–34. https://doi.org/10.1111/j.1464-0597.1997.tb01087.x

Berry, J. W. (2006). Acculturative stress. In P. T. P. Wong & L. C. J. Wong (Eds.), *Handbook of multicultural perspectives on stress and coping* (pp. 287–298). Springer. https://doi.org/10.1007/0-387-26238-5_12

Bethel, A., Ward, C., & Fetvadjiev, V. H. (2020). Cross-cultural transition and psychological adaptation of international students: The mediating role of host national connectedness. *Frontiers in Education*, *5*, Article 539950. https://doi.org/10.3389/feduc.2020.539950

Biggs, A., Brough, P., & Drummond, S. (2017). Lazarus and Folkman's psychological stress and coping theory. In C. L. Cooper & J. C. Quick (Eds.), *The handbook of stress and health: A guide to research and practice* (pp. 349–364). Wiley-Blackwell. https://doi.org/10.1002/9781118993811.ch21

Carmona-Halty, M., Schaufeli, W. B., Llorens, S., & Salanova, M. (2019). Satisfaction of basic psychological needs leads to better academic performance via increased psychological capital: A three-wave longitudinal study among high school students. *Frontiers in Psychology*, *10*, Article 2113. https://doi.org/10.3389/fpsyg.2019.02113

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., Duriez, B., Lens, W., Matos, L., Mouratidis, A., Ryan, R. M., Sheldon, K. M., Soenens, B., Van Petegem, S., & Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion*, *39*(2), 216–236. https://doi.org/10.1007/s11031-014-9450-1

Chen, H. (2025). Acculturative stress and university life adjustment among international students in China: The moderating role of perceived social support. *Frontiers in Psychology*, *16*, Article 1690645. https://doi.org/10.3389/fpsyg.2025.1690645

Chirkov, V., Ryan, R. M., Kim, Y., & Kaplan, U. (2003). Differentiating autonomy from individualism and independence: A self-determination theory perspective on internalization of cultural orientations and well-being. *Journal of Personality and Social Psychology*, *84*(1), 97–110. https://doi.org/10.1037/0022-3514.84.1.97

Choy, B., Arunachalam, K., Gupta, S., Taylor, M., & Lee, A. (2021). Systematic review: Acculturation strategies and their impact on the mental health of migrant populations. *Public Health in Practice*, *2*(3), Article 100069. https://doi.org/10.1016/j.puhip.2020.100069

Church, A. T., Katigbak, M. S., Locke, K. D., Zhang, H., Shen, J., Vargas-Flores, J. de J., Ibáñez-Reyes, J., Tanaka-Matsumi, J., Curtis, G. J., Cabrera, H. F., Mastor, K. A., Alvarez, J. M., Ortiz, F. A., Simon, J.-Y. R., & Ching, C. M. (2013). Need satisfaction and well-being: Testing self-determination theory in eight cultures. *Journal of Cross-Cultural Psychology*, *44*(4), 507–534. https://doi.org/10.1177/0022022112466590

Çimşir, E., & Ünlü Kaynakçı, F. Z. (2024). Acculturative stress and depressive symptoms among international university students: A meta-analytic investigation. *International Journal of Intercultural Relations*, *102*, Article 102041. https://doi.org/10.1016/j.ijintrel.2024.102041

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge. https://doi.org/10.4324/9780203771587

Cromhout, A., Schutte, L., & Wissing, M. P. (2018). Validation of the basic psychological needs scale in a South African student group. *South African Journal of Psychology*, *48*(4), 501–513. https://doi.org/10.1177/0081246317728267

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

Demes, K. A., & Geeraert, N. (2014). Measures matter: Scales for adaptation, cultural distance, and acculturation orientation revisited. *Journal of Cross-Cultural Psychology*, *45*(1), 91–109. https://doi.org/10.1177/0022022113487590

Deuchar, A. (2022). The problem with international students' 'experiences' and the promise of their practices: Reanimating research about international students in higher education. *British Educational Research Journal*, *48*(3), 504–518. https://doi.org/10.1002/berj.3779

de Wit, H. (2024). 'Everything that quacks is internationalization'—Critical reflections on the evolution of higher education internationalization. *Journal of Studies in International Education*, *28*(1), 3–14. https://doi.org/10.1177/10283153231221655

de Wit, H., & Deca, L. (2020). Internationalization of higher education, challenges and opportunities for the next decade. In A. Curaj, L. Deca, & R. Pricopie (Eds.), *European Higher Education Area: Challenges for a new decade* (pp. 3–11). Springer. https://doi.org/10.1007/978-3-030-56316-5_1

de Wit, H., & Wang, L. (2025). Internationalisation of higher education: Its conceptual evolution as a process, intended aims, and unintended effects in the global and European context. *European Journal of Education Policy and Practice*, *1*(3), 1–22. https://doi.org/10.5117/EJEP2025.3.001.DEWI

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Gagné, M. (2003). The role of autonomy support and autonomy orientation in prosocial behavior engagement. *Motivation and Emotion*, *27*(3), 199–223. https://doi.org/10.1023/A:1025007614869

Gebregergis, W. T., & Csukonyi, C. (2025a). Examining how positive intergroup contact and intercultural sensitivity facilitate sociocultural adaptation of international students by reducing intergroup anxiety. *Acta Psychologica*, *258*, Article 105241. https://doi.org/10.1016/j.actpsy.2025.105241

Gebregergis, W. T., & Csukonyi, C. (2025b). Unveiling psychological and sociocultural adaptation patterns of international students in Hungary. *Journal of International Students*, *15*(4), 97–118. https://doi.org/10.32674/21YQSE06

González-Arias, M., Dibona, P., Soto-Flores, B., Rojas-Puelles, A., Amato, M., Álvarez-Trigo, D., & Castillo, R. (2025). Academic performance, self-reported motivation, and affect in higher

education: The role of basic psychological need satisfaction. *Frontiers in Psychology*, *16*, Article 1519454. https://doi.org/10.3389/fpsyg.2025.1519454

Goodhue, D. L., Lewis, W., & Thompson, R. (2012). Does PLS have advantages for small sample size or non-normal data? *MIS Quarterly*, *36*(3), 981–1001. https://doi.org/10.2307/41703490

Gyasi-Gyamerah, K., Gyasi-Gyamerah, A. A., & Sakyi Boadu, E. (2025). Continental differences in international students' acculturative stress: Sources, social support, assertiveness, and self-efficacy. *Athens Journal of Psychology*, *1*(2), 117–138. https://doi.org/10.30958/ajpsy.1-2-4

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). SAGE Publications.

Hair, J. F., Jr., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). SAGE Publications.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hirai, R., Frazier, P., & Syed, M. (2015). Psychological and sociocultural adjustment of first-year international students: Trajectories and predictors. *Journal of Counseling Psychology*, *62*(3), 438–452. https://doi.org/10.1037/cou0000085

Jing, X., Ghosh, R., Sun, Z., & Liu, Q. (2020). Mapping global research related to international students: A scientometric review. *Higher Education*, *80*(3), 415–433. https://doi.org/10.1007/s10734-019-00489-y

Kock, N., & Hadaya, P. (2018). Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods. *Information Systems Journal*, *28*(1), 227–261. https://doi.org/10.1111/isj.12131

Koo, K. K., Baker, I., & Yoon, J. (2021). The first year of acculturation: A longitudinal study on acculturative stress and adjustment among first-year international college students. *Journal of International Students*, *11*(2), 278–298. https://doi.org/10.32674/jis.v11i2.1726

Kovács, L., & Kasza, G. (2018). Learning to integrate domestic and international students: The Hungarian experience. *International Research and Review: Journal of Phi Beta Delta Honor Society for International Scholars*, *8*(1), 26–43.

Kristiana, I. F., Karyanta, N. A., Simanjuntak, E., Prihatsanti, U., Ingarianti, T. M., & Shohib, M. (2022). Social support and acculturative stress of international students. *International Journal of Environmental Research and Public Health*, *19*(11), Article 6568. https://doi.org/10.3390/ijerph19116568

Ladum, A., & Burkholder, G. J. (2019). Psychological adaptation of international students in the northern part of Cyprus. *Higher Learning Research Communications*, *9*(1), 28–46. https://doi.org/10.18870/hlrc.v9i1.436

Lannert, J., & Derényi, A. (2020). Internationalization in Hungarian higher education. Recent developments and factors of reaching better global visibility. *Hungarian Educational Research Journal*, *10*(4), 346–369. https://doi.org/10.1556/063.2020.00034

Leow, S., Leow, K., & Ean, C. L. C. (2023). Satisfaction of basic psychological needs and eudaimonic well-being among first-year university students. *Cogent Social Sciences*, *9*(2), Article 2275441. https://doi.org/10.1080/23311886.2023.2275441

Lerias, D., Ziaian, T., Miller, E., Arthur, N., Augoustinos, M., & Pir, T. (2025). The role of acculturative stress on the mental health of immigrant youth: A scoping literature review. *Community Mental Health Journal*, *61*(3), 462–491. https://doi.org/10.1007/s10597-024-01351-x

Longo, Y., Gunz, A., Curtis, G. J., & Farsides, T. (2016). Measuring need satisfaction and frustration in educational and work contexts: The Need Satisfaction and Frustration Scale (NSFS). *Journal of Happiness Studies*, *17*, 295–317. https://doi.org/10.1007/s10902-014-9595-3

Mahmood, R., Wang, F. Y., Ahmed, W., Mahmood, S., Suleman, R. M. F., & Mahood, U. (2026). Psychological adaptation in international students' migration: Social support, meaning in life, and resilience in China. *Journal of International Students*, *16*(12), 25–56. https://doi.org/10.32674/s9217427

Malota, E., & Mucsi, A. (2025). The impact of acculturative stress and sociocultural adaptation on international student satisfaction and loyalty. *International Journal of Intercultural Relations*, *109*, Article 102292. https://doi.org/10.1016/J.IJINTREL.2025.102292

Martela, F., Lehmus-Sun, A., Parker, P. D., Pessi, A. B., & Ryan, R. M. (2023). Needs and well-being across Europe: Basic psychological needs are closely connected with well-being, meaning, and symptoms of depression in 27 European countries. *Social Psychological and Personality Science*, *14*(5), 501–514. https://doi.org/10.1177/19485506221113678

Matavovszky, D., Domján, S., Karner, O., & Nguyen Luu, L. A. (2026). Navigating emerging adulthood away from home: A structural equation modeling study of psychological, sociocultural, and academic adaptation among international students in Hungary. *International Journal of Intercultural Relations*, *115*, Article 102472. https://doi.org/10.1016/j.ijintrel.2026.102472

Maxwell, S. E., & Cole, D. A. (2007). Bias in cross-sectional analyses of longitudinal mediation. *Psychological Methods*, *12*(1), 23–44. https://doi.org/10.1037/1082-989X.12.1.23

Nalipay, M. J. N., King, R. B., & Cai, Y. (2020). Autonomy is equally important across East and West: Testing the cross-cultural universality of self-determination theory. *Journal of Adolescence*, *78*, 67–72. https://doi.org/10.1016/J.ADOLESCENCE.2019.12.009

Németh, T., Sütő, A., Sütő, B., & Marek, E. (2025). Beyond traditional study destinations: international students' cross-cultural experiences in Hungary. *Education Sciences, 15*(11), Article 1482. https://doi.org/10.3390/EDUCSCI15111482

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Pusztai, G., Fekete, I. D., Dusa, Á. R., & Varga, E. (2016). Knowledge brokers in the heart of Europe: International student and faculty mobility in Hungarian higher education. *Hungarian Educational Research Journal*, *6*(1), 60–75. https://doi.org/10.14413/HERJ.2016.01.04

Ren, Q., & Jiang, S. (2021). Acculturation stress, satisfaction, and frustration of basic psychological needs and mental health of Chinese migrant children: Perspective from basic psychological needs theory. *International Journal of Environmental Research and Public Health*, *18*(9), Article 4751. https://doi.org/10.3390/ijerph18094751

Ringle, C. M., Wende, S., & Becker, J.-M. (2015). *SmartPLS 3*. SmartPLS GmbH. https://www.smartpls.com

Ringle, C. M., Wende, S., & Becker, J.-M. (2024). *SmartPLS 4*. SmartPLS. https://www.smartpls.com

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press. https://doi.org/10.1521/978.14625/28806

Ryan, R. M., Jang, H., Wang, J. C. K., Matos, L., Gordeeva, T., Kaplan, H., Behzadnia, B., Kantas, Ö., Ferber, K. A., Soenens, B., & Vansteenkiste, M. (2025). Variations in need supports in education as a function of cultural and economic factors: Perspectives from self-determination theory. *Educational Psychology Review*, *37*(4), Article 118. https://doi.org/10.1007/s10648-025-10088-2

Sam, D. L., & Berry, J. W. (2010). Acculturation: When individuals and groups of different cultural backgrounds meet. *Perspectives on Psychological Science*, *5*(4), 472–481. https://doi.org/10.1177/1745691610373075

Sandhu, D. S., & Asrabadi, B. R. (1994). Development of an acculturative stress scale for international students: Preliminary findings. *Psychological Reports*, *75*(1), 435–448. https://doi.org/10.2466/pr0.1994.75.1.435

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2022). Partial least squares structural equation modeling. In C. Homburg, M. Klarmann, & A. Vomberg (Eds.), *Handbook of market research* (pp. 587–632). Springer. https://doi.org/10.1007/978-3-319-57413-4_15

Schürmann, L., Kärner, T., & Ringeisen, T. (2022). Need strength, perceived need support, stress symptomatology, and performance in the context of oral exams: A typological approach. *Frontiers in Psychology*, *13*, Article 992314. https://doi.org/10.3389/fpsyg.2022.992314

Searle, W., & Ward, C. (1990). The prediction of psychological and sociocultural adjustment during cross-cultural transitions. *International Journal of Intercultural Relations*, *14*(4), 449–464. https://doi.org/10.1016/0147-1767(90)90030-Z

Sheldon, K. M., & Hilpert, J. C. (2012). The balanced measure of psychological needs (BMPN) scale: An alternative domain general measure of need satisfaction. *Motivation and Emotion*, *36*(4), 439–451. https://doi.org/10.1007/S11031-012-9279-4

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*(6), 1273–1296. https://doi.org/10.1007/S11165-016-9602-2

Tong, L. (2020). Higher education internationalization and diplomacy: Successes mixed with challenges. A case study of Hungary's Stipendium Hungaricum scholarship program. *Hungarian Educational Research Journal*, *10*(4), 382–400. https://doi.org/10.1556/063.2020.00036

Torres-Arends, I., Jacobsen, M., Lang, B., & Sharma, A. (2025). Negotiating cultural and contextual experiences: Exploring acculturative stress and coping strategies among international students in Canada. *Journal of International Students*, *15*(9), 119–140. https://doi.org/10.32674/tsqkad73

UNESCO. (2025). *Higher education: Figures at a glance*. https://unesdoc.unesco.org/ark:/48223/pf0000394112

Vansteenkiste, M., Aelterman, N., De Muynck, G. J., Haerens, L., Patall, E., & Reeve, J. (2018). Fostering personal meaning and self-relevance: A self-determination theory perspective on internalization. *Journal of Experimental Education*, *86*(1), 30–49. https://doi.org/10.1080/00220973.2017.1381067

Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, *23*(3), 263–280. https://doi.org/10.1037/a0032359

Vansteenkiste, M., Ryan, R. M., & Soenens, B. (2020). Basic psychological need theory: Advancements, critical themes, and future directions. *Motivation and Emotion*, *44*(1), 1–31. https://doi.org/10.1007/s11031-019-09818-1

Wang, F., & Wang, Y. (2022). International student mobility and internationalization of higher education in Hungary and China: A comparative analysis. *Journal of Comparative & International Higher Education*, *14*(2), 85–95. https://doi.org/10.32674/jcihe.v14i2.3572

Wang, X., Lu, L., Wang, X., Qu, M., Yuan, L., Gao, Y., & Pan, B. (2021). Relationships between cross-cultural adaptation, perceived stress and psychological health among international undergraduate students from a medical university during the COVID-19 pandemic: A moderated mediation model. *Frontiers in Psychiatry*, *12*, Article 783210. https://doi.org/10.3389/fpsyt.2021.783210

Ward, C., & Kennedy, A. (1999). The measurement of sociocultural adaptation. *International Journal of Intercultural Relations*, *23*(4), 659–677. https://doi.org/10.1016/S0147-1767(99)00014-0

Xiang, W. (2024). Development trends and enlightenment of internationalization of higher education in the context of globalization. *International Journal of Education and Humanities*, *14*(3), 175–177. https://doi.org/10.54097/h1dhz974

Xu, J., & Chai, W. (2025). Navigating academic expectations and social integration: A moderated mediation analysis of cultural adaptation, peer support, and well-being among Chinese international students. *Frontiers in Psychology*, *16*, Article 1633773. https://doi.org/10.3389/fpsyg.2025.1633773

Xu, M., & Shapii, A. bt. (2025). Exploring the cross-cultural communication challenges of foreign students in China: The mediating effects of social media interaction and psychological resilience. *Frontiers in Psychology*, *16*, Article 1560298. https://doi.org/10.3389/fpsyg.2025.1560298

Xu, X., Huang, H., & Tran, L. (2026). Mapping global research on international students' cross-cultural adaptation: A structural topic modeling review. *International Journal of Intercultural Relations*, *112*, Article 102371. https://doi.org/10.1016/j.ijintrel.2026.102371

Yang, W., & Du, S. (2025). Constructing identity abroad: How Chinese students in Canada reconcile their cultural identity with Western influences. *Journal of International Students*, *15*(4), 153–169. https://doi.org/10.32674/yhe74762

Yang, Y., Zhang, Y., & Sheldon, K. M. (2018). Self-determined motivation for studying abroad predicts lower culture shock and greater well-being among international students: The mediating role of basic psychological needs satisfaction. *International Journal of Intercultural Relations*, *63*, 95–104. https://doi.org/10.1016/j.ijintrel.2017.10.005

Zhang, Y., & Jung, E. (2017). Multi-dimensionality of acculturative stress among Chinese international students: What lies behind their struggles? *International Research and Review: Journal of Phi Beta Delta Honor Society for International Scholars, 7*(1), 23–43.

Zhao, X., Lynch, J. G., Jr., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research*, *37*(2), 197–206. https://doi.org/10.1086/651257

Zheng, S., & Ishii, K. (2023). Cross-cultural adaptation of Chinese international students: Effects of distant and close support-seeking. *Frontiers in Psychology*, *14*, Article 1133487. https://doi.org/10.3389/fpsyg.2023.1133487

Author Bios

SABRINA HABBICHE (corresponding author), PhD candidate, is a doctoral researcher at the Doctoral School of Education, University of Szeged, Hungary. Her research focuses on cross-cultural psychology, with particular emphasis on international students' psychological well-being, acculturative stress, and cross-cultural adaptation. Her broader research interests include international student mobility, intercultural communication, and the internationalization of higher education. Email: sabrina.habbiche@edu.u-szeged.hu
ORCID: https://orcid.org/0009-0004-3813-1185

LÁSZLÓ KINYÓ, PhD, is an assistant professor and educational researcher at the Institute of Education, University of Szeged, Hungary. He obtained his PhD in Educational Science in 2012. His research interests include civic competence, social science education, educational assessment, computer-based assessment, and information and communication technologies in education. He also supervises doctoral students and serves as co-secretary of the Doctoral School of Education at the University of Szeged. Email: kinyo.laszlo.02@szte.hu
ORCID: https://orcid.org/0000-0002-3549-4018

SAIF HUSAM MOHAMMED, PhD, holds a doctorate in Educational Science from the University of Szeged, Hungary. He is an Educational Specialist at the Directorate of Educational Research, General Directorate of Educational Planning, Ministry of Education, Erbil, Kurdistan Region, Iraq. His research interests include constructivist and cognitive learning theories, technology-based learning, e-learning, metacognition, and educational assessment. Email: Mohammed.saif.husam@gmail.com
ORCID: https://orcid.org/0000-0002-2414-7133

SUPPLEMENTARY MATERIALS

Table S1.

Retrospective sample-size benchmarks and calculation assumptions

Assessment	Settings or calculation	Minimum N
G*Power fixed-model multiple regression: R^2 deviation from zero	Two predictors; $f^2 = .15$; $\alpha = .05$; target power = .80	68
Inverse-square-root method	One-tailed $\alpha = .05$; target power = .80; $(2.486 / \lvert\beta\rvert)^2 = 57.578$	58

Note. The analytical sample comprised 121 participants. The inverse-square-root calculation used the full-precision coefficient for acculturative stress to positive psychological adaptation ($|\beta| = .328$ when rounded to three decimal places), the smallest statistically significant structural coefficient in absolute magnitude. The required sample size was rounded upward. The constant 2.486 follows Kock and Hadaya (2018). G*Power's displayed power of .804 refers to N = 68. These are conditional retrospective benchmarks, not evidence of adequate power for every model path.

Table S2.

Results of Reflective Measurement Model Assessment After Item Deletion.

Constructs	Items	Loadings	Constructs	Items	Loadings
Autonomy α: 0.657	AUT1	0.500	**Perceived Hate α: 0.921**	PERHT1	0.850
	AUT3	0.858		PERHT2	0.907
	AUT6	0.865		PERHT3	0.891
Competence α: 0.718	COMP1_R	0.750		PERHT4	0.888
	COMP4	0.624		PERHT5	0.816
	COMP5_R	0.759	**Negative Psychological Adaptation α: 0.741**	NPSYA1	0.720
	COMP6_R	0.797		NPSYA2	0.691
Relatedness α: 0.721	REL1	0.825		NPSYA3	0.714
	REL2	0.712		NPSYA4	0.869
	REL5	0.647	**Positive Psychological Adaptation α : 0.731**	PSPSYA1	0.844
	REL8	0.740		PSPSYA2	0.536
Home Sickness α: 0.864	HMSICK1	0.850		PSPSYA3	0.799
	HMSICK2	0.912		PSPSYA4	0.781
	HMSICK3	0.794	**Social Adaptation α: 0.816**	SCA10	0.791
	HMSICK4	0.816		SCA11	0.749
Perceived Discrimination α: 0.921	PERDISC1	0.625		SCA12	0.631
	PERDISC2	0.802		SCA6	0.643
	PERDISC3	0.842		SCA8	0.788
	PERDISC4	0.866	**Miscellaneous α: 0.882**	SCA9	0.716
	PERDISC5	0.778		MISC2	0.491
	PERDISC6	0.817		MISC3	0.850
	PERDISC7	0.881		MISC4	0.714
	PERDISC8	0.785		MISC5	0.755
Guilt α: 0.801	GUILT1	0.928		MISC6	0.850
	GUILT2	0.897		MISC7	0.749
Fear α: 0.864	FEAR1	0.812		MISC8	0.717
	FEAR2	0.818		MISC9	0.798
	FEAR3	0.894		MISC10	0.513
	FEAR4	0.838			
Cultural Shock α: 0.777	CULSHOCK1	0.814			
	CULSHOCK2	0.848			
	CULSHOCK3	0.832			

Table S3.

Results of AVE Values Before and After Item Deletion

Construct	AVE Before Item Deletion	AVE After Item Deletion
Autonomy	0.309	0.578
Competence	0.387	0.541
Cultural Shock	0.691	0.691
Fear	0.708	0.707
Guilt	0.833	0.833
Homesickness	0.712	0.712
Miscellaneous	0.483	0.527
Negative Psychological Adaptation	0.492	0.565
Perceived Discrimination	0.645	0.645
Perceived Hate	0.758	0.759
Positive Psychological Adaptation	0.562	0.562
Relatedness	0.376	0.538
Sociocultural Adaptation	0.357	0.522

Table S4.

Composite reliability and Fornell-Larcker assessment for first-order constructs

Construct	CR	AVE	AUT	COMP	CUL SHOCK	FEAR	GUILT	HMSICK	MISC	NPSYA	PERDISC	PERHT	PSPSYA	REL	SCA
AUT	0.796	0.578	**0.760**												
COMP	0.824	0.541	0.293	**0.736**											
CUL SHOCK	0.870	0.691	-0.419	-0.216	**0.832**										
FEAR	0.906	0.707	-0.304	-0.199	0.440	**0.841**									
GUILT	0.909	0.833	-0.188	-0.187	0.408	0.407	**0.913**								
HMSICK	0.908	0.712	-0.094	-0.182	0.479	0.225	0.522	**0.844**							
MISC	0.907	0.527	-0.323	-0.238	0.590	0.559	0.507	0.451	**0.726**						
NPA	0.837	0.565	-0.193	-0.363	0.507	0.243	0.446	0.686	0.510	**0.752**					
PERDISC	0.935	0.645	-0.240	-0.201	0.472	0.457	0.333	0.219	0.636	0.276	**0.803**				
PERHT	0.940	0.759	-0.327	-0.156	0.523	0.663	0.442	0.248	0.724	0.305	0.773	**0.871**			
PPA	0.833	0.562	0.420	0.086	-0.371	-0.267	-0.244	-0.275	-0.403	-0.183	-0.471	-0.485	**0.750**		
REL	0.822	0.538	0.527	0.154	-0.386	-0.282	-0.191	-0.146	-0.424	-0.131	-0.336	-0.396	0.510	**0.734**	
SCA	0.867	0.522	0.494	0.241	-0.461	-0.274	-0.251	-0.347	-0.447	-0.421	-0.394	-0.404	0.351	0.358	**0.722**

Note. CR = composite reliability; AVE = average variance extracted. Diagonal entries are the square roots of AVE; off-diagonal entries are construct correlations. AUT = autonomy; COMP = competence; CULSHOCK = cultural shock; FEAR = fear; GUILT = guilt; HMSICK = homesickness; MISC = miscellaneous; NPA = negative psychological adaptation; PERDISC = perceived discrimination; PERHT = perceived hate; PPA = positive psychological adaptation; REL = relatedness; SCA = sociocultural adaptation.

Table S5.

Heterotrait-Monotrait Ratios for Reflective Constructs

Panel A. First-Order Constructs After Item Deletion

Construct	AUT	COMP	CUL	FEAR	GUILT	HMSICK	MISC	NPA	PERDISC	PERHT	**PPA**	**REL**	**SCA**
AUT	—												
COMP	0.436	—											
CUL	0.580	0.308	—										
FEAR	0.401	0.249	0.537	—									
GUILT	0.294	0.246	0.515	0.485	—								
HMSICK	0.189	0.237	0.580	0.265	0.620	—							
MISC	0.427	0.313	0.723	0.627	0.613	0.532	—						
NPA	0.355	0.493	0.672	0.300	0.565	0.836	0.636	—					
PERDISC	0.280	0.249	0.556	0.510	0.386	0.247	0.681	0.340	—				
PERHT	0.399	0.205	0.614	0.746	0.522	0.280	0.797	0.364	0.826	—			
PPA	0.512	0.261	0.473	0.322	0.317	0.356	0.462	0.317	0.546	0.576	—		
REL	0.726	0.300	0.495	0.348	0.261	0.212	0.511	0.241	0.401	0.477	0.659	—	
SCA	0.618	0.309	0.579	0.321	0.316	0.409	0.512	0.534	0.421	0.449	0.430	0.428	—

Note. AUT = autonomy; COMP = competence; CULSHOCK = cultural shock; FEAR = fear; GUILT = guilt; HMSICK = homesickness; MISC = miscellaneous stressors; NPA = negative psychological adaptation; PERDISC = perceived discrimination; PERHT = perceived hate; PPA = positive psychological adaptation; REL = relatedness; SCA = sociocultural adaptation.

Panel B. Reflective Adaptation Outcomes in the Second-Stage Model

Construct	NPA	PPA	SCA
Negative psychological adaptation	—		
Positive psychological adaptation	0.317	—	
Sociocultural adaptation	0.534	0.430	—

Note. HTMT = heterotrait–monotrait ratio. Panel A presents reflective first-order constructs after item deletion; Panel B presents reflective adaptation outcomes in the second-stage model. Formative higher-order constructs are excluded. Values are rounded to three decimal places.

Table S6.

Results of the Formative Measurement Model for Higher-Order Constructs

Construct	Dimension	Scale Type	Weight	Loading	Outer VIF
Acculturative Stress (AS)	Cultural Shock	Formative	0.393	0.846	1.792
	Fear	Formative	-0.070	0.514	1.918
	Guilt	Formative	-0.025	0.559	1.672
	Homesickness	Formative	0.358	0.713	1.681
	Perceived Discrimination	Formative	0.130	0.677	2.653
	Perceived Hate	Formative	0.164	0.723	4.149
	Miscellaneous	Formative	0.295	0.845	2.791
Basic Psychological Needs Satisfaction (BPNS)	Autonomy	Formative	0.489	0.853	1.478
	Competence	Formative	0.273	0.502	1.096
	Relatedness	Formative	0.534	0.834	1.383

Table S7.

Discriminant Validity Assessment of Adaptation Constructs in the Second-Stage Model

Construct	AS	BPNS	NPA	PPA	SCA
AS	-				
BPNS	-0.464	-			
NPA	0.660	-0.283	**0.751**		
PPA	-0.498	0.520	-0.218	**0.746**	
SCA	-0.535	0.506	-0.434	0.371	**0.722**

Note. BPNS = basic psychological needs satisfaction; AS = acculturative stress; NPA = negative psychological adaptation; PPA = positive psychological adaptation; SCA = sociocultural adaptation
Acculturative Stress and Basic Psychological Needs Satisfaction were modeled as formative higher-order constructs; therefore, AVE was not calculated for these constructs. Discriminant validity was assessed separately for the reflective constructs.

Table S8.

Harman-Style Unrotated Principal Components Diagnostic

Result	**Value**
Retained indicators entered	60
First component eigenvalue	17.463
Variance explained by first component	29.105%
Components with eigenvalues greater than 1	15
Cumulative variance explained by those components	75.262%

Note. Principal components were extracted from the correlation matrix without rotation, using listwise deletion. This diagnostic cannot rule out common-method bias.

Table S9.

Explanatory and Predictive Assessment of the Second Stage Model

Construct	R^2	Blindfolding Q^2	PLSpredict Q^2predict	Lower RMSE than LM	Lower MAE than LM
AS	0.223	Not interpreted[1]	0.135	-	-
NPA	0.433	0.219	0.055	0/4	0/4
PPA	0.355	0.170	0.226	1/4	1/4
SCA	0.372	0.172	0.210	3/6	2/6

Note. N = 121. Saturated SRMR = .0968; estimated SRMR = .0989. Both SRMR values exceeded .08 but remained below .10 at full precision; their proximity to .10 warrants caution. R^2 and SRMR are from the SmartPLS 4 second-stage algorithm output. Blindfolding used omission distance 7 in SmartPLS 3. PLSpredict used SmartPLS 4, 10 folds, 10 repetitions, Early antecedents, and a fixed seed. LM = linear-model benchmark. Counts show indicators for which PLS-SEM prediction error was lower than LM prediction error, using unrounded values. Positive indicator-level Q^2predict occurred for 3/4 negative-adaptation, 4/4 positive-adaptation, and 6/6 sociocultural-adaptation indicators.

[1] Acculturative stress is a formative higher-order construct; its second-stage blindfolding value is not interpreted as conventional reflective-outcome predictive relevance. Blindfolding Q^2 and PLSpredict Q^2predict assess different aspects of prediction. PLSpredict evaluates the supplied second-stage model conditional on previously generated construct scores; it does not independently validate the entire measurement pipeline.