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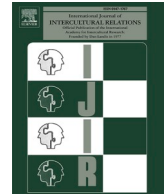
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Development of cultural intelligence during international student mobility: The role of prior intercultural exposure and personality

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ABSTRACT

Cultural intelligence (CQ) plays a crucial role in enabling individuals to operate and interact effectively in a variety of multicultural environments. In this paper, we examine how prior intercultural exposure and personality factors shape the development of CQ during international student mobility. Two waves of data were collected from 549 engineering students over a nine-month period. Measures included the eleven subdimensions of expanded cultural intelligence (E-CQ), information on prior intercultural exposure (migration background, prior residence abroad, and number of countries visited), personality factors (openness and extraversion), and gender. Results from latent change score models revealed that nine of the eleven subdimensions of E-CQ increased significantly following international mobility. Students with lower initial E-CQ levels demonstrated greater growth compared to their peers with higher initial E-CQ levels. Openness and extraversion were positively associated with higher initial levels of metacognitive, cognitive, and motivational CQ but were related to smaller gains in motivational CQ (self-efficacy) and behavioral CQ (speech acts). Prior intercultural exposure was associated with higher initial E-CQ levels but was generally related to lower CQ growth, except for metacognitive CQ (planning). Our results show that international mobility significantly enhances CQ, with the most significant improvements observed among students with lower levels of openness, extraversion, or prior intercultural exposure. They highlight the importance of designing mobility programs that foster CQ while taking into account different levels of prior intercultural exposure.

Globalization and increasing cultural diversity in the workplace have highlighted the need for individuals to develop their cultural intelligence (CQ; [Richter, van Bakel, et al., 2020](#)). Most researchers define CQ as “the capability of an individual to function effectively in culturally diverse settings” ([Van Dyne et al., 2012](#), p. 295). Empirical research has demonstrated that CQ predicts a variety of important outcomes in cross-cultural contexts (for reviews see [Ott & Michailova, 2018](#); [Fang et al., 2018](#)), including expatriation intention ([Richter, Schlaegel, et al., 2020](#)), cross-cultural adjustment ([Lin et al., 2012](#)), expatriate job performance ([Chen et al., 2010](#)), negotiation performance ([Imai & Gelfand, 2010](#)), and global project team performance and satisfaction ([Henderson et al., 2018](#)). Understanding how CQ develops is therefore critical. Recent studies have demonstrated that international student mobility significantly increases CQ ([Chédru & Ostapchuk, 2023](#); [McKay, Lannegrand, Skues, & Wise, 2022](#); [Zimmermann, Greischel, & Jonkmann,](#)

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2021). However, the role and nature of variables such as prior intercultural exposure remain unclear. While some studies suggest that the most significant benefits of international mobility are observed among participants with the least prior intercultural exposure (Goldstein, 2022; McKeown, 2009; Vande Berg et al., 2009; Zimmermann et al., 2021), these findings have not been systematically replicated (Iskhakova et al., 2021; McKay et al., 2022). The multifaceted nature of prior intercultural exposure may explain these seemingly contradictory results. Indeed, researchers such as Ott and Iskhakova (2019) have recommended a nuanced definition and conceptualization of intercultural exposure. Furthermore, Fang et al. (2018) emphasized the importance of focusing on specific intercultural experiences and their relationship to specific aspects of CQ.

To address these issues, we used two-wave longitudinal data collected nine months apart from engineering students who spent a semester abroad. To thoroughly assess the participants' previous intercultural exposure, we considered three distinct variables: their migration background, prior residence abroad, and the number of foreign countries visited. We measured the eleven subdimensions of cultural intelligence (Expanded CQ or E-CQ), and accounted for gender and personality factors, specifically openness and extraversion. In the first step, we examined whether students' eleven subdimensions of CQ increased following international mobility. In the second step, we investigated whether students with the lowest initial CQ scores experienced the most significant progression in CQ subdimensions. Finally, we explored the role of gender, personality traits (openness and extraversion), and prior intercultural exposure as sources of individual differences in initial levels and rates of change in CQ. Using latent change score modeling, this study provides deeper insights into how prior intercultural exposure, personality, and gender shape the development of CQ during international student mobility.

Defining and measuring CQ

Based on the pioneering work of Earley and Ang (2003) and the subsequent research of Van Dyne et al. (2012), CQ consists of four dimensions and eleven subdimensions. Metacognitive CQ refers to how individuals interpret and make sense of intercultural experiences. It encompasses the mental processes used to acquire and understand cultural knowledge. Key components of metacognitive CQ include (Van Dyne et al., 2012): i) planning, i.e., strategizing prior to intercultural interactions, ii) awareness, i.e., knowing about cultural thinking and knowledge of self and others in real time, and iii) checking, i.e., reviewing assumptions and adjusting mental frameworks when real-life experiences differ from initial expectations.

Cognitive CQ focuses on explicit knowledge about values, norms, practices, and conventions in different cultures acquired through education and personal experience (Ang et al., 2007). It includes: i) culture-general knowledge, defined as knowledge of the universal elements that make up a cultural environment, and ii) context-specific knowledge, defined as declarative knowledge about the manifestations of cultural universals in a particular domain and procedural knowledge about how to be effective in that domain (Van Dyne et al., 2012).

Motivational CQ reflects the ability to direct attention and energy toward learning about and functioning in situations characterized by cultural differences (Ang et al., 2007). It refers to an individual's level of interest, drive, and energy to adapt cross-culturally (Van Dyne, Ang, & Livermore, 2010). Motivational CQ includes: i) intrinsic interest, defined as valuing a culturally diverse experience because it is inherently satisfying, ii) extrinsic interest, defined as valuing the tangible, personal benefits that can be derived from culturally diverse experiences, and iii) self-efficacy to adjust, i.e., having task-specific confidence in a cross-cultural encounter (Van Dyne et al., 2012).

Behavioral CQ reflects the ability to exhibit appropriate behaviors when interacting with people from different cultures (Ang et al., 2007). It comprises: i) verbal behavior, i.e., flexibility in vocalization (e.g., accent, tone), ii) nonverbal behavior, i.e., flexibility in communication that is conveyed through gestures, facial expressions, and body language rather than words, and iii) speech acts, i.e., flexibility in the way certain types of messages are conveyed, such as requests, invitations, apologies, gratitude, or disagreement (Van Dyne et al., 2012).

Most studies on CQ development have used Earley and Ang's (2003) framework, which conceptualizes CQ as a four-dimensional first-order aggregated construct comprising correlated cognitive, metacognitive, motivational, and behavioral dimensions. This model has also underpinned the most widely used measure of CQ—the 20-item self-report CQ scale (CQS; Ang et al., 2007). However, as proposed by Van Dyne et al. (2012), CQ can also be conceptualized as an eleven-factor construct with four correlated second-order factors. Despite its theoretical relevance, the eleven-factor model and its corresponding Expanded Cultural Intelligence Scale (E-CQS) have seen limited empirical application, with a few exceptions (Chédru & Delhoume, 2023; Chédru & Ostapchuk, 2023; Richter, Schlaegel, van, Bakel, & Engle, 2020). Following the recommendations of Van Dyne et al. (2012) and more recently Morin and Talbot (2023), we chose to use the eleven-factor construct and the E-CQS in our research. We believe that this more detailed framework should provide a more comprehensive understanding of how particular intercultural experiences influence the development of specific facets of CQ.

Defining international student mobility and intercultural exposure in the context of CQ development

Ott and Iskhakova (2019) argue that the conflicting findings on the effectiveness of international experience in developing CQ can be partly attributed to the lack of clarity surrounding the concept of international experience and its measurement. They emphasize the importance of clarifying these aspects in future research.

In our study, we use the term "international student mobility" to refer to student mobility experiences such as study semesters or internships abroad. International student mobility thus corresponds to an immersion experience in a foreign country with engagement in educational activities and interactions with people from diverse cultural backgrounds. This experience helps students become

familiar with the norms, values, and beliefs of other cultures and develop an understanding of them (Ott & Iskhakova, 2019, p. 402).

We use the term “prior intercultural exposure” to describe an individual’s overall intercultural background prior to departure. While “intercultural exposure” is often associated with interactions with other cultures through travel or stays abroad, it also includes broader experiences such as an individual’s migration background (e.g., dual citizenship) and non-travel-related exposures, like living in a multicultural environment (Vin Reaes & Burakova, 2023). In this study, we operationalize prior intercultural exposure using three key variables: migration background, prior residence abroad, and the number of foreign countries visited. These variables aim to capture essential aspects of both travel-related and non-travel-related forms of intercultural exposure. However, we acknowledge that certain non-travel-related dimensions, such as living in a multicultural environment, are not explicitly addressed within this operationalization. Building on Crowne’s (2013) framework, we also distinguish between the breadth of exposure, which refers to the number of foreign countries visited, and the depth of exposure, characterized by the type of experience, duration, and degree of immersion in a culture. The three variables used in this study reflect key aspects of both breadth and depth. For instance, the number of countries visited reflects breadth, while prior residence abroad and migration background provide insights into depth, particularly in terms of cultural immersion and lived experience.

CQ development during students’ long-term international mobility

Experiential Learning Theory (ELT; Kolb, 1984) provides a robust framework for understanding how international student mobility fosters the development of CQ. By immersing students in an unfamiliar cultural environment, international mobility creates a context for continuous learning and adaptation. According to ELT, learning is a cyclical process comprising four stages: concrete experiences, reflective observation, abstract conceptualization, and active experimentation (Kolb & Kolb, 2005). During international mobility, students engage in tangible cultural experiences, reflect on such encounters, integrate new cultural knowledge, and experiment with culturally appropriate behaviors. This dynamic process enhances their ability to navigate and understand diverse cultural contexts, thereby significantly developing their CQ (Iskhakova et al., 2021; Li et al., 2013).

It is widely assumed that the longer the duration of immersion abroad, the greater the increase in CQ (Eisenberg et al., 2013; Li et al., 2013; McKay et al., 2022; Pasztor, 2021). Specifically, a longer stay provides more opportunities for students to cycle through the four experiential learning modes, thereby enhancing each dimension or subdimension of their CQ. However, previous research on students’ CQ development has predominantly focused on the effects of shorter stays abroad (e.g., study tours), typically lasting 2 weeks to 2 months (e.g., Chang Alexander et al., 2022; Varela & Gatlin-Watts, 2014; Wood & St. Peters, 2014; see Goldstein, 2022 and Iskhakova & Bradly, 2022 for systematic reviews). Studies examining the effects of long-term immersion, defined as six months or more, remain relatively scarce (Chao, Takeuchi, & Farh, 2017; Chédru & Delhoume, 2023; Chédru & Ostapchuk, 2023; Gosling, 2023; McKay, Lannegrand, Skues, & Wise, 2022; Zimmermann, Greischel, & Jonkmann, 2021).

McKay et al. (2022) showed that a semester-long exchange increased cognitive, metacognitive, and motivational CQ for both Australian and French students, while behavioral CQ only improved for Australian students. Chao et al. (2017) reported similar findings for Hong Kong students, with CQ improvements linked to social adjustment. Chédru and Ostapchuk (2023) showed that a study abroad semester increased ten of eleven subdimensions of E-CQ for French engineering students (with the exception of extrinsic interest), while Chédru and Delhoume (2023) found that women benefited more than men across various CQ dimensions. Gosling (2023) demonstrated positive effects on Taiwanese students’ CQ as a result of a 9–12 month international internship, particularly in cognitive and motivational CQ. Zimmermann et al. (2021) focused on metacognitive CQ and found significant improvements in German students after an international mobility experience of varying duration, from one to nine months.

Predictors of level and change in CQ

Among the key antecedents of CQ, intercultural exposure and individual differences play a crucial role (Fang et al., 2018; Ott & Michailova, 2018). This study aims to examine the effects of prior intercultural exposure, personality traits, and gender on both initial levels and subsequent changes in CQ.

Prior intercultural exposure. Previous studies on the effects of prior intercultural exposure on initial levels of CQ have revealed mixed results (Ott & Michailova, 2018; Fang et al., 2018). While many focused on the breadth of exposure, such as the number of countries visited (Iskhakova et al., 2021; McKay et al., 2022; Morrell et al., 2013), others examined its depth (Eisenberg et al., 2013; Zimmermann et al., 2021) or both aspects (Crowne, 2008). For instance, Morrell et al. (2013) found a positive relationship between the number of countries visited and all four dimensions of CQ, whereas Eisenberg et al. (2013) showed that living, working, or studying abroad for at least 6 months enhanced metacognitive, cognitive, and motivational CQ. Crowne (2008) reported that travel for work or education increased overall CQ, especially metacognitive and cognitive dimensions, whereas vacation travel was linked to higher motivational CQ.

Previous research suggests that international mobility tends to be more beneficial for students who start with lower levels of intercultural knowledge and experience. In 2009, McKeown introduced the concept of first-time effect. The author argues that studying abroad challenges students by forcing them into intense encounters with diversity. The first-time effect suggests that students who are experiencing international mobility for the first time achieve the biggest gains in intellectual development, possibly because this initial experience has a disproportionate impact on them compared to their more internationally experienced peers (McKeown, 2009, p. 118). Vande Berg et al. (2009), using the Intercultural Development Inventory (IDI), found that students with no prior experience living in another culture or limited study abroad experience had the lowest initial levels of intercultural competence. However, these students demonstrated the most significant improvements during their study abroad, indicating that those starting

with lower intercultural competence made the greatest gains.

Iskhakova et al. (2021) proposed that students with minimal international experience may not have fully engaged in the experiential learning cycle prior to mobility programs, resulting in lower initial levels of CQ. The immersive and intensive nature of mobility programs' environments facilitates significant CQ growth, particularly for those with limited international experience. Consequently, students with less intercultural exposure tend to exhibit steeper learning curves and greater CQ development following their study abroad experiences. Conversely, students who begin with higher levels of CQ may experience a 'ceiling effect,' where the international experience does not result in as steep an increase in their CQ as it does for their peers who start with lower levels (McKay et al., 2022).

To date, studies on the role of prior intercultural exposure in driving both initial levels and development of CQ for students participating in long-term mobility programs are rare and have produced contradictory results. Zimmermann et al. (2021) found that students at German higher education institutions with a migration background (i.e., at least one parent born outside of Germany) and prior international mobility experiences (i.e., living abroad for at least one month) had higher initial levels of metacognitive CQ. In addition, they showed that students without prior international mobility experience benefited the most from such experiences, showing greater increases in metacognitive CQ compared to their peers who had already lived abroad. McKay et al. (2022) showed that Australian students with more travel experience (having visited five or more countries) had higher levels of behavioral and cognitive CQ prior to participating in a semester exchange program. In contrast, French students with more travel experience showed higher levels of motivational and metacognitive CQ. Furthermore, prior travel experience did not influence the degree of change in CQ during the mobility program for either group.

Personality. Fang et al. (2018) highlight that openness to experience is a key personality trait linked to all dimensions of CQ. This trait involves curiosity, a willingness to embrace novelty, and a desire to explore new cultures (Costa & McCrae, 1992). Studies show that openness to experience is positively related to all CQ dimensions (Ang et al., 2006; Li et al., 2016) and to overall CQ (Depaula et al., 2016; Harrison, 2012). Individuals high in openness are more knowledgeable about other cultures (cognitive CQ), enjoy new environments (motivational CQ), question cultural assumptions (metacognitive CQ), and adapt their behaviors in new contexts (behavioral CQ).

Most studies have shown that extraversion is positively related to three dimensions of CQ: cognitive, motivational, and behavioral CQ (Ang et al., 2006; Depaula et al., 2016), as well as to overall CQ (Depaula et al., 2016). Extroverted individuals are sociable, confident, and energetic, traits that help them engage with diverse cultures. They actively seek interactions, enhancing their cultural knowledge (cognitive CQ), pursue new experiences (motivational CQ), and adapt their behavior in social settings (behavioral CQ) (Ang et al., 2006).

Studies on the effect of personality on CQ development have revealed inconsistent results. Open-minded individuals, characterized by curiosity and a willingness to engage with new experiences, are generally believed to experience greater increases in CQ after international experiences. For instance, Fischer (2011) and Şahin et al. (2014) found that those high in openness reported greater gains in motivational CQ following intercultural exposure. This aligns with the distinction made by Van der Zee and van Oudenhoven (2013), who categorize personality traits into social-perceptual traits (like open-mindedness and social initiative) and stress-related traits (like emotional stability and flexibility). Social-perceptual traits are thought to help individuals recognize the challenges in intercultural interactions and respond with positive affect. Extroverts, often associated with high social initiative, are similarly assumed to benefit more from international experiences. Şahin et al. (2014), for instance, demonstrated improvements in metacognitive and behavioral CQ among highly extroverted individuals. However, Chédru and Ostapchuk (2023) reported contrasting findings: students with low openness and low extraversion showed greater improvements in CQ after a study abroad semester. They suggested that this could be due to the mandatory nature of the program, which included students who might not have chosen to study abroad otherwise—particularly those with low openness. Additionally, since most participants had limited prior international experience, the impact of the study abroad semester on CQ development may have been greater for those with lower openness and less intercultural exposure.

Gender. Research shows that female students are more likely to study abroad compared to their male peers (Netz et al., 2020), with this gender gap persisting across various fields of study and countries (Van Mol, 2022). This trend may reflect women's greater interest in learning about other cultures, whereas men focus more on entering the labor market (Tompkins, Cook, Miller, & LePeau, 2017). Although one might expect these differences to translate into variations in CQ, the research findings are mixed. For example, some studies found no significant gender differences in CQ (Ang et al., 2006; Tu et al., 2020), yet others identified higher metacognitive CQ levels in women than in men (Zimmermann et al., 2021; Khodadady & Ghahari, 2011). Research also suggests that gender affects CQ development during international mobility, with women showing greater increases in most CQ dimensions compared to men (Chédru & Delhoume, 2023; Chédru & Ostapchuk, 2023). Similarly, Vande Berg et al. (2009) further noted that women made greater intercultural gains abroad compared to men.

Interaction between gender and personality. Since the relationships between personality and CQ might vary by gender (Ang, Van Dyne, & Koh, 2006; Chédru & Delhoume, 2023), we also examined the interaction effects of gender and personality by including interaction terms as predictors of both the initial level and the change in CQ.

The present study

The present study is guided by three main objectives. First, in line with previous research, we aim to verify whether students' eleven subdimensions of cultural intelligence increase as a result of international mobility. Secondly, the objective is to ascertain whether students with the lowest initial scores in cultural intelligence experience the most significant progression following international mobility. Finally, we seek to explore the role of gender, personality traits (openness and extraversion), and prior intercultural exposure

as sources of individual differences in initial levels and rates of change in cultural intelligence. In contrast to previous research, our analyses include a number of factors to assess the extent of participants' prior intercultural exposure. These factors include the number of foreign countries visited, their experience of living abroad (excluding leisure time and tourism), and the participants' migration background. The originality of our study also lies in the adoption of an expanded model of cultural intelligence and, from a methodological perspective, in the use of latent change score modeling.

Methods

Participants and procedure

A total of 549 engineering students participated in the study. Each of the students was required to spend one semester abroad. This was the fifth semester of a five-year degree program. The mean age of the students was 19.5 years (SD = 0.7 years) at Time 1 and 20.3 years (SD = 0.7 years) at Time 2. The majority of respondents (98.7 %) were French, studying either agronomy (50 %), food and health science (35 %), or geosciences and environment (15 %). The respondents were predominantly female (57 %, $n = 313$) with male respondents accounting for 43 % ($n = 236$). The semester abroad was conducted in 48 different countries. The ten most popular destinations, which collectively accounted for 68 % of the student population, were: Ireland ($n = 93$), the Netherlands ($n = 58$), Belgium ($n = 42$), Spain ($n = 34$), Australia ($n = 32$), Germany ($n = 26$), Malta ($n = 23$), the United States ($n = 23$), Canada ($n = 22$), and Denmark ($n = 20$).

The participants completed all the measures (cultural intelligence, personality, previous intercultural exposure) and demographic questions in May (Time 1), approximately one to two months before they began their semester abroad. The same measures were repeated in February of the following year (Time 2), approximately one to two months after the participants' return. The questionnaires were made available online and completed in class, thus allowing for the possibility of answering any questions that might arise. In accordance with the principles of the 'French charter of ethics for research professions', the students completed a consent form that specifies that there are no right or wrong answers and that the answers are treated confidentially and anonymously.

Measures

Cultural intelligence. Across the two data collection phases, CQ was assessed using 33 items from the French version of the Expanded Cultural Intelligence Scale (Gagné-Deland, 2017; Van Dyne et al., 2012). The responses were recorded on a seven-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The scale is comprised of four dimensions and eleven subdimensions. To provide a concise representation of the two subdimensions of cognitive CQ (culture-general knowledge and context-specific knowledge), the number of items was reduced from five to three. To more effectively address students' immediate concerns, the original items of the extrinsic interest subdimension were modified (Chédru & Ostapchuk, 2023). For example, instead of focusing on the benefits of working in a different culture (e.g., status, reputation, promotion) as in the original scale, we focused on the benefits of living or studying in a different culture (e.g., international career opportunities, global networks and connections, increased employability). A sample item for each construct is the following: (i) Metacognitive CQ, planning (3 items; α Time 1 = 0.64, α Time 2 = 0.73), "I ask myself what I hope to accomplish before I meet people from different cultures."; awareness (3 items; α Time 1 = 0.76, α Time 2 = 0.73), "I am aware of how my culture influences my interactions with people from different cultures"; checking (3 items; α Time 1 = 0.69, α Time 2 = 0.71), "I update my cultural knowledge after a cultural misunderstanding"; (ii) Cognitive CQ, culture-general knowledge (3 items; α Time 1 = 0.75, α Time 2 = 0.78), "I can describe the different cultural value frameworks that explain behaviors around the world"; context-specific knowledge (3 items; α Time 1 = 0.84, α Time 2 = 0.88), "I can describe different ways to motivate and reward people across cultures"; (iii) Motivational CQ, intrinsic interest (3 items; α Time 1 = 0.79, α Time 2 = 0.84), "I truly enjoy interacting with people from different cultures"; extrinsic interest (3 items; α Time 1 = 0.67, α Time 2 = 0.77), "I value the global networks and connections I could gain from studying or living abroad"; self-efficacy to adjust (3 items; α Time 1 = 0.78, α Time 2 = 0.79), "I am confident that I can persist in coping with living conditions in different cultures"; (iv) Behavioral CQ, verbal behavior (3 items; α Time 1 = 0.74, α Time 2 = 0.76), "I vary my verbal behaviors (accent, tone, rate of speaking) to fit specific cultural contexts."; non-verbal behavior (3 items; α Time 1 = 0.73, α Time 2 = 0.77), "I modify how close or far apart I stand when interacting with people from different cultures"; and speech acts (3 items; α Time 1 = 0.82, α Time 2 = 0.84), "I modify the way I disagree with others to fit the cultural setting". All Cronbach's alpha coefficients indicate satisfactory reliability. Although the alpha for planning at Time 1 is below the conventional threshold of 0.70 (Nunnally & Bernstein, 1994), it may still be deemed acceptable given the scale's brevity with only three items.

Personality and demographics. To assess the personality traits of openness and extraversion, we used items from the French version of the Big Five Inventory – BFI-Fr (John et al., 1991; Plaisant et al., 2010). Answers were recorded on a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Eight items were used to assess extraversion (e.g., "I see myself as someone who is outgoing, sociable"), while ten were used to assess openness (e.g., "I see myself as someone who is original, comes up with new ideas"). Cronbach's alpha coefficients (0.86 for extraversion, and 0.73 for openness) suggest satisfactory reliability (Nunnally & Bernstein, 1994). Participants also reported their age and gender (female, male, other, prefer not to answer).

Previous intercultural exposure. In order to obtain comprehensive information about the multifaceted nature of the participants' previous intercultural exposure, three key variables were considered: the participants' migration background, whether they had ever lived abroad, and the number of foreign countries they had visited.

Migration background. The participants' migration background was determined based on the nationalities of the students and

their parents. Students were classified as having no migration background if both they and their parents exclusively held French nationality. Conversely, students were classified as having a migration background if they, or at least one of their parents, held a nationality other than French, even as a second nationality. For example, a student with dual nationality (French and another) was considered to have a migration background, regardless of their parents' exclusive French nationality. Students born and raised in French overseas territories were classified using the same criteria and were not treated as a distinct group. It is important to note that this operationalization does not take into account earlier generational migration histories (e.g., third-generation migrants who, like their parents, hold French nationality). The variable was dummy-coded (0 = no migration background, 1 = migration background). Our sample included 49 students with a migration background (8.9%).

Prior residence abroad. At Time 1, participants were asked if they had ever lived abroad, explicitly excluding experiences related to tourism or leisure. Participants who responded 'yes' were categorized as having prior residence abroad, regardless of the duration (i.e., from less than one year to over five years). This variable was binary-coded (0 = has never lived abroad, 1 = has already lived abroad). This broad categorization aimed to include any significant exposure to a different cultural context that extended beyond travel or short-term leisure activities. A total of 87 students reported having already lived abroad (15.8%).

Number of foreign countries visited. At Time 1, participants were asked to report the total number of foreign countries that they had visited. On average, the number of foreign countries they had visited before departure was 6.4 (SD = 2.9 countries).

Statistical analyses

All statistical analyses were conducted using SPSS and AMOS (Arbuckle, 2021). The analyses were carried out in three stages. First, latent measurement models for the E-CQ constructs were developed (see Fig. 1) and subjected to tests for measurement invariance. Secondly, to capture longitudinal changes, latent change score models were constructed based on the latent E-CQ factors (see Fig. 2). Third, to investigate the role of gender, personality traits (openness and extraversion), and prior intercultural exposure on both the initial levels and changes in E-CQ, we included these variables in our models. This resulted in the construction of conditional latent change score models, as depicted in Fig. 3.

As the questionnaires were completed in class, and because a completeness check was implemented in the online questionnaires, only few obvious cases of missing values were observed and excluded from the study. For example, some students were absent at Time 2 due to having repeated a year. Others were absent at Time 1 because they entered the program in the third year (parallel admission). In both cases, the results were excluded as they did not allow a comparison to be made before and after the mobility abroad.

Measurement invariance testing

We conducted confirmatory factor analyses to test whether the E-CQ dimensions demonstrated measurement invariance across time (see Fig. 1). In accordance with the recommendations of Widaman et al. (2010), we tested for each E-CQ dimension three levels of measurement invariance: configural, metric, and scalar invariance.

The initial step was to assess configural invariance. At this level, the baseline model permits the factor structure to vary across time points. Correlations between residuals of identical items across time points were allowed. The fit of the model was evaluated by

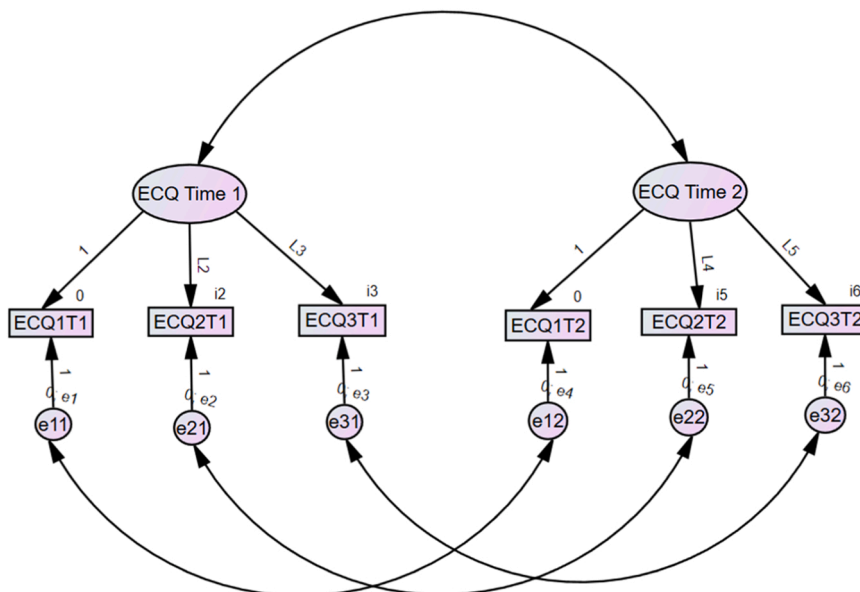


Fig. 1. Latent measurement model.

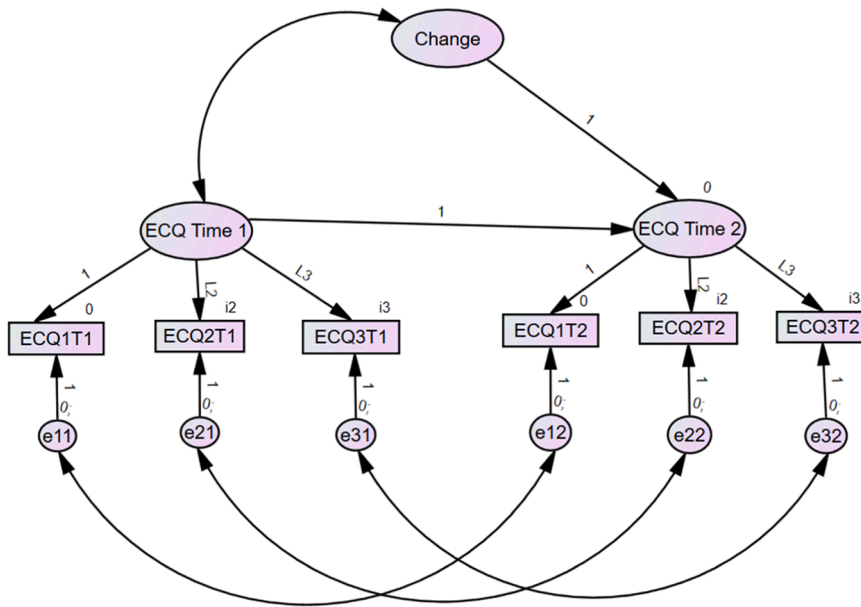


Fig. 2. Unconditional latent change score model.

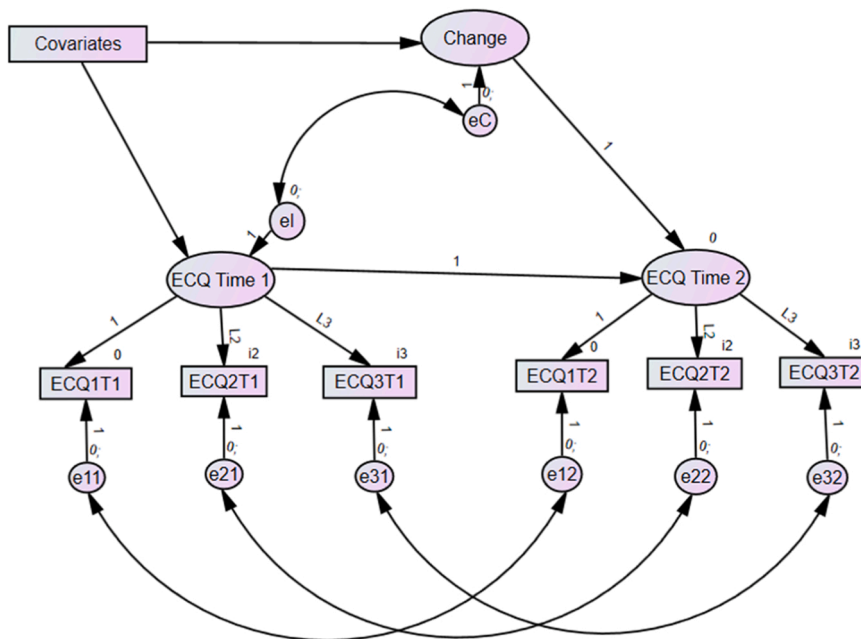


Fig. 3. Conditional latent change score model.

examining the comparative fit index (CFI), the root mean square error approximation (RMSEA), and the standardized root mean square residual (SRMR). According to Hu and Bentler (1999), CFI values close to 0.95 or above, RMSEA values close to 0.06 or lower, and SRMR values close to 0.08 or lower are indicative of a satisfactory model fit (Hu & Bentler, 1999). The configural models for each E-CQ dimension demonstrated an acceptable fit to the data, indicating that the same latent variables are being measured at both time points. A detailed summary of the model fit statistics can be found in the Appendix. The next step was to evaluate metric invariance (or weak invariance). This was done by contrasting the basic configural invariant model with a model in which factor loadings were constrained to be equal across time points. The achievement of metric invariance indicates that the constructs are measured in an identical manner at both Time 1 and Time 2. Finally, scalar invariance (or strong invariance) was tested by additionally constraining item intercepts to be equal across time points. Scalar invariance is a prerequisite for the comparison of latent variable means across time points.

Table 1
Means, standard deviations, and correlations between study variables.

Variables	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Time 1																														
1. Gender (% women)	57.0																													
Prior intercultural exposure																														
2. Migration background (% yes)	8.90	.01																												
3. Prior residence abroad (% yes)	15.80	.00	.18**																											
4. Country number	6.36	2.86	.09*	.14**	.24**																									
Personality variables																														
5. Openness (1 – 5)	3.49	.60	.06	.03	.14**	.09*																								
6. Extraversion (1 – 5)	3.28	.81	-.04	.02	.09*	.06	.15**																							
Metacognitive CQ																														
7. Planning (1 – 7)	4.31	1.09	.06	-.10*	.02	-.00	.10*	.01																						
8. Awareness (1 – 7)	5.36	.99	.16**	.04	.07	.04	.24**	.07	.29**																					
9. Checking (1 – 7)	5.08	1.02	.13**	.00	.14**	.06	.27**	-.00	.30**	.52**																				
Cognitive CQ																														
10. Culture-g. know. (1 – 7)	4.39	1.17	-.08	.04	.14**	.11**	.26**	.04	.22**	.27**	.29**																			
11. Context-s. know. (1 – 7)	3.46	1.20	-.18**	.03	.08	.00	.10*	.19**	.27**	.10*	.19**	.45**																		
Motivational CQ																														
12. Intrinsic interest (1 – 7)	5.00	1.11	.22**	.10*	.16**	.25**	.35**	.09*	.13**	.29**	.37**	.26**	.14**																	
13. Extrinsic interest (1 – 7)	5.07	1.19	.14**	.03	.16**	.13**	.14**	.11**	.08	.18**	.18**	.14**	.11*	.35**																
14. Self-efficacy to adjust (1 – 7)	5.20	1.06	.00	.03	.17**	.09*	.26**	.31**	.01	.23**	.20**	.24**	.16**	.39**	.24**															
Behavioral CQ																														
15. Verbal behavior (1 – 7)	4.49	1.20	.01	.06	.13**	.01	.03	.08*	.23**	.28**	.38**	.18**	.30**	.18**	.12**	.13**														
16. Non-verbal behavior (1 – 7)	4.59	1.20	.06	.03	.11**	.06	.07	.08	.19**	.31**	.33**	.20**	.19**	.19**	.18**	.12**	.58**													
17. Speech acts (1 – 7)	4.53	1.20	.03	.03	.09*	.05	.09*	.08	.24**	.31**	.33**	.21**	.25**	.15**	.13**	.09*	.58**	.65**												
Time 2																														
Metacognitive CQ																														
18. Planning (1 – 7)	4.41	1.22	.04	.07	.05	.01	.11*	.04	.32**	.20**	.23**	.17**	.18**	.16**	.11**	.09*	.21**	.20**	.23**											
19. Awareness (1 – 7)	5.62	.91	.22**	.09*	.05	.09*	.23**	.04	.19**	.36**	.29**	.15**	.02	.27**	.11**	.16**	.15**	.20**	.19**	.36**										
20. Checking (1 – 7)	5.29	1.05	.17**	.07	.05	.07	.26**	-.04	.13**	.29**	.45**	.19**	.01	.31**	.16**	.22**	.17**	.25**	.24**	.35**	.48**									
Cognitive CQ																														
21. Culture-g. know. (1 – 7)	4.91	1.12	-.02	.10*	.03	.06	.23**	.10*	.12**	.24**	.24**	.41**	.22**	.19**	.21**	.20**	.14**	.11*	.11*	.23**	.38**	.35**								
22. Context-s. know. (1 – 7)	3.98	1.30	-.14**	.07	.06	.00	.09*	.20**	.18**	.18**	.16**	.28**	.38**	.13**	.17**	.20**	.22**	.19**	.20**	.40**	.24**	.28**	.52**							
Motivational CQ																														
23. Intrinsic interest (1 – 7)	5.28	1.18	.14**	.09*	.11**	.14**	.24**	.06	.07	.15**	.27**	.12**	.06	.59**	.29**	.29**	.16**	.14**	.13**	.22**	.34**	.46**	.28**	.28**						
24. Extrinsic interest (1 – 7)	5.07	1.33	.09*	.08	.11**	.09*	.07	-.01	.06	.11**	.15**	.07	.04	.25**	.59**	.16**	.11**	.11**	.09*	.18**	.22**	.26**	.26**	.25**	.42**					
25. Self-efficacy to adjust (1 – 7)	5.67	.96	.06	.06	.11*	.03	.17**	.16**	.03	.19**	.22**	.10*	.04	.21**	.14**	.43**	.13**	.12**	.11**	.12**	.34**	.33**	.31**	.28**	.46**	.29**				
Behavioral CQ																														
26. Verbal behavior (1 – 7)	4.66	1.27	.07	.08	.09*	.06	.08	.09*	.12**	.19**	.23**	.17**	.17**	.17**	.16**	.17**	.39**	.36**	.36**	.38**	.30**	.38**	.28**	.43**	.31**	.21**	.21**			
27. Non-verbal behavior (1 – 7)	4.85	1.31	.12**	.07	.06	.04	-.00	.06	.11**	.23**	.20**	.08	.08	.16**	.19**	.16**	.31**	.40**	.32**	.34**	.29**	.34**	.21**	.37**	.24**	.27**	.20**	.62**		
28. Speech acts (1 – 7)	4.74	1.31	.10*	.05	.03	.07	-.01	.02	.16**	.22**	.19**	.06	.10*	.15**	.18**	.10*	.29**	.36**	.40**	.37**	.28**	.30**	.18**	.30**	.18**	.21**	.19**	.50**	.69**	

CQ = cultural intelligence. N = 549

* p < .05.

** p < .01.

To test metric invariance, [Chen \(2007\)](#) suggested that a change of ≥ -0.010 in CFI, along with a change of ≥ 0.015 in RMSEA or a change of ≥ 0.030 in SRMR would indicate noninvariance. For scalar invariance, a change of ≥ -0.010 in CFI, along with a change of ≥ 0.015 in RMSEA or a change of ≥ 0.010 in SRMR would indicate noninvariance ([Chen, 2007](#)). The χ^2 difference test was not used due to its high sensitivity to sample size ([Meade et al., 2008](#)).

Overall, while configural and metric invariance were supported across the two time points for each of the eleven E-CQ dimensions, scalar invariance was not fully established for planning and checking, according to the criteria proposed by [Chen \(2007\)](#). This indicates that there are discrepancies in the item intercepts between the two time points for these two constructs. For planning, a significantly worsened fit was obtained when comparing the metric invariant model with the scalar invariant model ($\Delta CFI = -0.025$, and $\Delta RMSEA = 0.022$). Moreover, the RMSEA of the scalar model, with a value of 0.072, exceeds the threshold recommended by [Hu and Bentler \(1999\)](#). Detailed results are reported in the Appendix. Further investigation revealed that the reduced fit was primarily attributable to constraining the intercepts of the item “I think about possible cultural differences before meeting people from other cultures” to be equal across time. Consequently, a partial strong invariant model was constructed, wherein the invariance constraint for the intercepts of this item was relaxed. This resulted in an improvement in fit. The model demonstrated an acceptable fit, thereby supporting the hypothesis of partial strong time invariance for planning.

Similarly, for checking, a significantly worsened fit was obtained when comparing the metric invariant model with the scalar invariant model ($\Delta CFI = -0.025$, and $\Delta RMSEA = 0.032$). Moreover, the RMSEA of the scalar model, with a value of 0.071, exceeds the threshold recommended by [Hu and Bentler \(1999\)](#). We noticed that the reduced fit was largely attributable to constraining the intercepts of the item “I update my cultural knowledge after a cultural misunderstanding” to be equal across time. We therefore modeled a partial strong invariant model where the invariance constraint for the intercepts of this item was relaxed. This resulted in an improvement in fit. The model demonstrated an acceptable fit, thereby supporting the hypothesis of partial strong time invariance for checking.

To address partial strong invariance for the planning and checking constructs, we followed [Widaman et al., \(2010\)](#) recommendation to employ both a full strong invariance model and a partial strong model for comparison in subsequent analyses. When both types of models showed the same patterns of significance and the same magnitudes of estimates, we reported only the results from the full strong invariance model.

Latent change score models

In order to evaluate the change in E-CQ during international mobility, we used latent change score models ([McArdle, 2009](#); [Steyer et al., 1997](#)). In these models, the mean of the intercept represents the average initial level of the variable under study. The variance of the intercept reflects the variability in the initial levels of the variable across individuals. The mean of the latent change variable represents the average difference or change between two data collection phases. The variance of the latent change variable reflects the variability in the amount of change observed between individuals over time. It indicates how much individuals differ in terms of their change trajectories. A positive correlation between the intercept and change means that individuals who started with higher scores experienced faster growth rates compared to those who started with lower scores. Conversely, a negative correlation suggests that individuals who started with lower scores experienced faster growth rates than those who started with higher scores. To ensure reliable interpretation of all latent parameters, we enforced strong measurement invariance. However, for the variables ‘planning’ and ‘checking,’ we also took partial measurement invariance into account. The residuals of identical items over time were allowed to correlate with each other, as well as the intercept variable with the change variable ([Fig. 2](#)).

There are several advantages to using latent change score models. First, because latent scores are free of measurement error, the resulting difference scores reflect changes more accurately than traditional difference scores based on manifest variables. Second, this

Table 2
Means and variances of latent intercept and latent change, correlation between intercept and change.

	Latent intercept (L _i)		Latent change (L _c)		Correlation between L _i and L _c
	Mean	Variance	Mean	Variance	
Planning					
M3 = Scalar invariance	3,97 ^{***}	0,75 ^{***}	0,07	1,14 ^{***}	-0,43 ^{***}
M3a = Partial Scalar invariance	3,90 ^{***}	0,76 ^{***}	0,19 ^{**}	1,17 ^{***}	-0,44 ^{***}
Awareness	5,48 ^{***}	0,68 ^{***}	0,25 ^{***}	0,70 ^{***}	-0,60 ^{***}
Checking					
M3 = Scalar invariance	5,31 ^{***}	0,450 ^{***}	0,17 ^{***}	0,42 ^{***}	-0,43 ^{***}
M3a = Partial Scalar invariance	5,28 ^{***}	0,44 ^{***}	0,24 ^{***}	0,41 ^{***}	-0,43 ^{***}
Culture-g. know.	4,40 ^{***}	0,78 ^{***}	0,45 ^{***}	0,82 ^{***}	-0,54 ^{***}
Context-s. know.	3,28 ^{***}	1,17 ^{***}	0,51 ^{***}	1,53 ^{***}	-0,48 ^{***}
Intrinsic interest	5,43 ^{***}	0,82 ^{***}	0,26 ^{***}	0,65 ^{***}	-0,33 ^{***}
Extrinsic interest	4,91 ^{***}	0,87 ^{***}	-0,01	0,61 ^{***}	-0,13*
Self-efficacy to adjust	5,47 ^{***}	0,57 ^{***}	0,39 ^{***}	0,53 ^{***}	-0,55 ^{***}
Verbal behavior	4,00 ^{***}	0,97 ^{***}	0,18 ^{**}	1,18 ^{***}	-0,50 ^{***}
Non-verbal behavior	4,33 ^{***}	1,29 ^{***}	0,26 ^{***}	1,54 ^{***}	-0,43 ^{***}
Speech acts	4,50 ^{***}	1,16 ^{***}	0,21 ^{***}	1,32 ^{***}	-0,45 ^{***}

Table 3

Standardized beta coefficients from regression analyses with all predictors of initial level and change in metacognitive E-CQ.

	Planning ¹		Awareness		Checking ¹	
	Initial level	Change	Initial level	Change	Initial level	Change
Women	-.22	-.05	.04	.16	.27	-.05
Openness	.02	-.00	.27***	.01	.34***	-.01
Extraversion	.06	.05	.01	-.08	-.07	-.03
Women x Openness	.58	.08	-.02	-.24	-.18	.10
Women x Extraversion	-.30	-.06	.16	.13	.02	.01
Migration background	-.13*	.19***	.02	.06	-.04	.10
Prior residence abroad	.04	-.01	.03	-.03	.14**	-.13*
Country number	-.00	-.01	-.00	.05	-.00	.02

* p < .05; ** p < .01; *** p < .001.

¹ Results from the full strong invariance model.**Table 4**

Standardized beta coefficients from regression analyses with all predictors of initial level and change in cognitive E-CQ.

	Culture-g. know.		Context-s. know.	
	Initial level	Change	Initial level	Change
Women	.03	-.07	.06	-.03
Openness	.28***	-.04	.10	-.06
Extraversion	.01	.04	.24***	.08
Women x Openness	-.05	.03	-.03	.23
Women x Extraversion	-.10	.13	-.23	-.18
Migration background	.01	.09	.02	.04
Prior residence abroad	.10*	-.13*	.06	-.02
Country number	.09	-.05	-.01	-.01

* p < .05; ** p < .01; *** p < .001.

approach allows us to examine not only mean changes over time but also the variability of both initial levels and changes (i.e., inter-individual differences). Third, latent change score models provide valuable insights by capturing the information derived from the correlation between intercept and change. This correlation can shed light on the relationship between an individual's initial level and their subsequent rate of change, providing a deeper understanding of how individuals differ in their developmental trajectories over time.

Predictors of E-CQ

To investigate the potential contributors to E-CQ, all variables were simultaneously included as predictors of both the initial level and change in E-CQ (see Fig. 3). In addition, interaction terms between gender and personality (gender x openness and gender x extraversion) were also included as predictors of the initial level and change in E-CQ.

Results

Table 1 presents the descriptive statistics and pairwise correlations of all variables included in the study.

Table 5

Standardized beta coefficients from regression analyses with all predictors of initial level and change in motivational E-CQ.

	Intrinsic interest		Extrinsic interest		Self-efficacy to adjust	
	Initial level	Change	Initial level	Change	Initial level	Change
Women	.86**	-.01	.31	.28	.08	.23
Openness	.39***	-.06	.11	-.04	.26***	-.02
Extraversion	.16*	-.05	.15	-.08	.30***	-.21**
Women x Openness	-.21	-.20	-.00	-.05	-.17	-.31
Women x Extraversion	-.47*	.13	-.16	-.33	.08	.14
Migration background	.05	.01	-.00	.10	-.01	.06
Prior residence abroad	.06	-.03	.14**	-.05	.13**	-.06
Country number	.23***	-.10	.11*	-.02	.03	-.05

* p < .05; ** p < .01; *** p < .001.

Table 6

Standardized beta coefficients from regression analyses with all predictors of initial level and change in behavioral E-CQ.

	Verbal behavior		Non-verbal behavior		Speech acts	
	Initial level	Change	Initial level	Change	Initial level	Change
Women	.44	.13	.56	-.14	.31	-.30
Openness	.10	.05	.10	-.12	.14	-.16*
Extraversion	.08	.04	.15	.01	.07	-.06
Women x Openness	-.43	.05	-.31	.26	-.30	.33
Women x Extraversion	.01	-.13	-.21	-.05	.00	.07
Migration background	.05	.03	.02	.05	.01	.05
Prior residence abroad	.15**	-.08	.11*	-.06	.07	-.04
Country number	-.04	.06	.01	.00	.02	.02

* $p < .05$; ** $p < .01$; *** $p < .001$.*Initial levels and changes in E-CQ*

Our analyses involved the specification of eleven latent change models, each corresponding to one dimension of the E-CQ (Fig. 2). All models showed an adequate fit to the data with CFIs ≥ 0.976 , RMSEA ≤ 0.067 , and SRMR ≤ 0.034 .

Table 2 presents the means and variances of the latent changes and intercepts, as well as the correlation between change and intercept.

For all subdimensions of E-CQ, the variance of latent change was statistically significant. This indicates that students differ significantly in their trajectories of change: some may have experienced an increase in E-CQ, while others may have experienced a constant value or even a decrease over time.

For nine variables, the mean latent change is positive and significant meaning that, on average, students showed statistically significant growth in these subdimensions of their E-CQ between Time 1 and Time 2. For extrinsic interest, the mean latent change was not significant, meaning that, on average, there was no statistically significant change in students' extrinsic interest from Time 1 to Time 2. Under partial invariance, the mean latent change for planning became positive and significant ($p < .01$), whereas it was not significant under strong invariance. When the constraints on the specific item that led to a poor fit were relaxed, the data revealed a significant increase in planning from Time 1 to Time 2.

For all subdimensions of E-CQ, the correlation between the latent intercept and the latent change was negative and statistically significant. Except for extrinsic interest ($-.13$), the correlations were strong (between $-.33$ and $-.60$). These negative correlations mean that students with lower initial levels of E-CQ showed more growth, on average, than students who started with higher initial levels of E-CQ. In addition, we can notice that the variances of the latent intercepts were statistically significant, meaning that there was considerable variability in students' initial levels of E-CQ.

Predictors of E-CQ

To explore the role of prior intercultural exposure, personality traits (openness and extraversion), and gender as sources of individual differences in initial levels and rates of change in cultural intelligence, all variables were simultaneously included as predictors of both initial levels and changes in E-CQ (Fig. 3). The results of the metacognitive, cognitive, motivational, and behavioral dimensions of E-CQ are presented in Tables 3 through 6, respectively.

For the metacognitive subdimensions of E-CQ, students who reported higher levels of openness demonstrated higher initial levels of awareness and checking. Students without a migration background reported higher initial levels of planning, while those who had lived abroad reported higher initial levels of checking. Students with a migration background reported more growth in planning, while those who had never lived abroad reported more growth in checking.

Regarding the cognitive subdimensions of E-CQ, students with higher levels of openness and extraversion reported higher initial levels of culture-general and context-specific knowledge, respectively. Students who had lived abroad showed higher initial levels of culture-general knowledge, while those who had never lived abroad experienced greater increases in culture-general knowledge.

For the motivational subdimensions of E-CQ, women showed higher initial levels of intrinsic interest. Students with higher levels of openness and extraversion reported higher levels of both intrinsic interest and self-efficacy to adjust. Students with lower levels of extraversion experienced greater increases in self-efficacy to adjust. While both extraversion and being female were positively associated with higher initial levels of intrinsic interest, the significant negative interaction effect between gender and extraversion suggests that the positive impact of extraversion on initial intrinsic interest was diminished for women. In other words, although women generally had higher initial intrinsic motivation, the increase in intrinsic interest associated with being more extraverted was smaller for women than for men. In terms of previous intercultural exposure, students who had lived abroad showed higher initial levels of extrinsic interest and self-efficacy to adjust. The more foreign countries students had visited, the higher their initial levels of both intrinsic and extrinsic interests.

Regarding the behavioral subdimensions of E-CQ, students with lower levels of openness experienced a greater increase in speech acts. Finally, students who had lived abroad showed higher initial levels of verbal and non-verbal behaviors.

Discussion

The present study had three main objectives: to examine whether students' eleven subdimensions of CQ increased after international mobility, to determine whether students with the lowest initial CQ scores experienced the most significant growth, and to explore the role of gender, personality traits (openness and extraversion), and prior intercultural exposure in influencing initial levels and rates of change in CQ.

First, the results showed that, except for extrinsic interest and planning, the mean latent change in the E-CQ variables was positive and significant, indicating statistically significant growth in nine of the eleven E-CQ subdimensions after international mobility. For planning, the mean latent change became positive and significant only under the condition of partial invariance. Second, negative and statistically significant correlations between latent intercept and latent change for all E-CQ subdimensions suggest that students with lower initial E-CQ levels exhibited more growth than those with higher initial levels. Third, gender, openness, extraversion, and prior intercultural exposure variables were associated with higher and/or lower levels of and changes in E-CQ subdimensions. The results thus demonstrated the importance of examining the unique contribution of a variety of factors as predictors of initial CQ levels and their development during international student mobility.

This study stands out by offering several advantages over most previous research on the impact of international mobility on CQ development. First, it employs the Expanded Cultural Intelligence Scale (E-CQS) rather than the traditional CQS, providing a more detailed assessment of CQ (Chédru & Ostapchuk, 2023). Second, it uses latent change score modeling instead of conventional statistical analyses. This approach not only allows for a more nuanced understanding of how international mobility influences specific CQ components but also yields more accurate change estimates by eliminating measurement error. Our results align with those of Chédru and Ostapchuk (2023), who, using a mixed between-within subjects analysis of variance, demonstrated that a study abroad semester had a statistically significant effect on the development of each E-CQ subdimension over time, with the exception of extrinsic interest. In the present study, we observed a significant latent change in the variable 'planning' under conditions of partial invariance, in contrast to strong invariance. This difference was attributed to the item "I think about possible cultural differences before meeting people from other cultures" which showed poor fit under strong invariance. The non-invariance of this item could indicate specific variations in how participants understood or responded to this item at the two different time points. We recommend future research to explore the reasons for this non-invariance. This may involve interviews or qualitative analyses to understand participants' perceptions. Another possibility could be to consider revising or replacing the problematic item in future studies to improve measurement invariance. Although the mean latent change for extrinsic interest is not significant, the significant variance in latent change suggests that individual experiences varied: some students may have shown an increase in extrinsic interest, while others may have maintained a constant level or even experienced a decrease over time.

The negative and statistically significant correlations between latent intercept and latent change across all E-CQ subdimensions suggest that students with lower initial E-CQ levels showed more growth than their peers with higher initial levels. This finding aligns with the work of Vande Berg et al. (2009), who also found, using the Intercultural Development Inventory (IDI), that students starting with the lowest levels of intercultural competence made the greatest gains after their study abroad experience. To our knowledge, however, our study is the first to demonstrate this outcome using the E-CQS. This insight is particularly noteworthy because it shows that international mobility is especially beneficial for students with lower initial levels of CQ, allowing them to make substantial gains and potentially close the gap with those who had higher pre-departure levels of CQ.

Our findings, consistent with previous research (Ang et al., 2006; Li et al., 2016), reveal that students with higher levels of openness demonstrated greater initial levels of awareness and checking (metacognitive CQ), culture-general knowledge (cognitive CQ), intrinsic interest, and self-efficacy to adjust (motivational CQ). Similarly, students with higher extraversion exhibited higher initial levels of context-specific knowledge (cognitive CQ), intrinsic interest, and self-efficacy to adjust (motivational CQ). However, contrary to Ang et al. (2006), Li et al. (2016), and Depaula et al. (2016), we found no significant relationship between openness or extraversion and behavioral CQ. This discrepancy may result from the more detailed approach adopted in our study, which considers various subdimensions for each CQ primary factor. The absence of a significant association between openness or extraversion and behavioral CQ subdimensions suggests that, while individuals high in openness and extraversion may be cognitively and motivationally prepared for intercultural interactions, this readiness does not necessarily translate into behavioral adaptations, such as verbal and non-verbal behaviors or speech acts. While prior studies have widely explored the relationships between the Big Five personality traits and the four primary CQ factors (e.g., Ang et al., 2006), future research should investigate how the Big Five dimensions relate to the eleven subdimensions of E-CQ.

Regarding changes in E-CQ, students with lower levels of openness showed greater increases in speech acts, while those with lower levels of extraversion exhibited more substantial gains in self-efficacy to adjust. This finding challenges the common assumption that individuals who are naturally open and extroverted benefit the most from international experiences (Fischer, 2011; Şahin, Gurbuz, & Köksal, 2014; Van der Zee & van Oudenhoven, 2013). Instead, it suggests that international student mobility programs may be particularly advantageous for those who are less inclined to seek out intercultural interactions, offering them a significant opportunity to improve their CQ. This finding aligns with the results obtained by Chédru & Ostapchuk (2023), further emphasizing the importance of these programs in fostering CQ development among students with lower initial intercultural engagement. It underscores the need to actively support and encourage a more diverse range of students to participate in such programs.

Our finding that women exhibit higher initial levels of intrinsic interest compared to men is consistent with broader trends indicating that women are more likely to study abroad and seek cultural learning opportunities (Netz et al., 2020; Van Mol, 2022). However, contrary to some previous research (Chédru & Delhoume, 2023; Vande Berg, Connor-Linton, & Paige, 2009), our study did not observe greater gains in CQ for women following international mobility compared to men. This difference may stem from gender

differences becoming less pronounced when other factors, such as personality and prior intercultural exposure, are taken into account. These results underscore the complexity of variables influencing CQ development and highlight the importance of incorporating these factors into CQ research, particularly when designing inclusive and effective international mobility programs to enhance CQ.

Among the three variables related to intercultural exposure, “prior residence abroad” has the most significant impact on both the initial levels of E-CQ and their subsequent development. When considering Crowne’s (2013) distinction between breadth and depth of exposure, our findings suggest that depth (captured through prior residence abroad and migration background) plays a critical role in shaping all four dimensions of CQ. In contrast, breadth (measured by the number of countries visited) appears to primarily influence motivational CQ, particularly intrinsic and extrinsic interest. However, in line with McKay et al. (2022), breadth does not impact the degree of change in any of the four dimensions of CQ.

The variable “prior residence abroad” is particularly noteworthy, as students who have lived abroad exhibit higher initial E-CQ levels but do not show the greatest increases in E-CQ. Conversely, students who have never lived abroad demonstrate the most significant growth in E-CQ (e.g., checking and culture-general knowledge), suggesting a ceiling effect for the former group and a first-time effect for the latter. These findings are consistent with those of Zimmermann et al. (2021), who observed similar trends when examining metacognitive CQ. In their study, Zimmermann et al. (2021) concluded that international student mobility is particularly beneficial for students who had not previously participated in international mobility experiences.

Building on the recommendations of Ott and Iskhakova (2019) and Fang et al. (2018), our study underscores the importance of providing a nuanced and detailed definition of prior intercultural exposure. By examining its different components and using an expanded measure of CQ, we can better understand how each type of intercultural experience uniquely influences specific facets of CQ. Specifically, breadth may foster curiosity and openness to diverse cultures, while depth provides opportunities for deeper cultural understanding and skill development. This more nuanced understanding also helps clarify previous contradictory findings in the literature, showing that what once seemed inconsistent can be interpreted in a more coherent manner. These complementary roles - where breadth enhances curiosity and openness, and depth facilitates deeper understanding and skill development - highlight the need for higher education institutions to consider both aspects when designing international mobility programs to maximize their impact on CQ development. While these findings offer valuable insights, further studies are needed to confirm and expand upon our results.

Implications

This study highlights that students enter international mobility programs with diverse initial E-CQ levels, influenced by factors such as prior intercultural exposure, personality traits, and gender. However, our results show that, on average, E-CQ levels of all students increased after international mobility, and more importantly, the mobility experience helped to close the gaps between students. Such results underline the value of international student mobility programs as a strategic investment for higher education institutions. By fostering significant improvements in CQ among students with initially lower levels, these programs contribute to a more equitable development of CQ across the student body. Regardless of the explanatory variables taken into account (personality, gender, prior intercultural exposure), the initial advantages - such as higher E-CQ scores for students who had lived abroad or those who were more open - did not translate into significantly larger growth, suggesting a potential ceiling effect. On the other hand, students with lower initial E-CQ levels exhibited greater growth during mobility, illustrating a first-time effect. These findings reinforce the notion that international student mobility programs stand out as valuable tools for promoting the development of CQ within diverse student populations.

Building on these findings, we propose practical recommendations for higher education institutions to better leverage both breadth and depth of intercultural exposure in the design of international mobility programs. Specifically, institutions could implement targeted pre-departure and in-mobility activities tailored to students’ varying levels of prior exposure. For students with limited intercultural experience, preparatory workshops focusing on cultural awareness, adaptability, and intercultural communication could help mitigate initial adjustment challenges and maximize the first-time effect. Conversely, for students with substantial prior exposure, advanced programs emphasizing deeper cultural engagement could be introduced. These might include internships or research projects within the host culture, allowing these students to further develop their CQ in meaningful ways. In addition, institutions could design mobility programs that deliberately encourage a mix of students with diverse intercultural exposure backgrounds, fostering peer learning and mutual support. For instance, pairing students with extensive travel experience with those who have had limited exposure could create opportunities for mutual enrichment and deeper intercultural understanding.

Limitations

Several limitations must be considered when interpreting our results. First, the use of self-assessments to measure students’ CQ and personality factors may introduce social desirability bias, as participants may feel inclined to report more favorable outcomes of their international mobility experience (Ogden, 2015). Future research could address this limitation through a mixed-methods approach, combining self-assessments with external evaluations, such as peer assessments or behavioral observations, to provide a more comprehensive and objective measure of CQ development. Conducting pre- and post-experience interviews could also offer valuable qualitative insights to validate and enrich the findings. Second, because international mobility was mandatory, we could not compare CQ development with a control group. Therefore, the observed changes may not be solely attributable to the mobility experience but could also reflect general maturation (Ogden, 2015). Third, our operationalization of migration background has limitations. We did not explicitly differentiate students from French overseas territories, whose distinct cultural contexts warrant separate analysis. Additionally, by focusing on immediate parental nationality, we overlooked earlier generational migration (e.g., third-generation

migrants), potentially underestimating the cultural complexity of some participants. Fourth, the categorization of prior residence abroad into a single group, regardless of the duration or nature of the stay, may have overlooked key nuances in participants' intercultural experiences. While our sample, consisting of students, is less likely to have had extended professional stays abroad, variations such as short-term exchanges, internships, or family relocations could still influence cultural exposure. Future research could benefit from a more detailed classification, considering duration thresholds or specific types of residence abroad (e.g., study, work, or family-related stays). Fifth, although this study considered prior intercultural exposure through migration background, prior residence abroad, and the number of foreign countries visited, it did not account for non-travel-related exposures, such as growing up in a multicultural family or living in a diverse environment. Including these dimensions could provide a more nuanced understanding of intercultural experiences. Finally, given the originality and complexity of our study, which involves numerous variables, further research is needed to confirm our findings, particularly across a broader range of nationalities and fields of study.

Conclusion

This research, using the E-CQS and latent change score modeling, provides robust empirical evidence that international student mobility significantly enhances CQ. Specifically, the results show that international mobility is particularly advantageous for students with lower initial levels of CQ, enabling them to make substantial gains and potentially narrow the gap with their peers who had higher pre-departure CQ levels. The study also demonstrates that students with higher levels of openness or extraversion, as well as those with greater prior intercultural exposure, tend to have higher initial E-CQS scores compared to their peers. However, this initial advantage does not necessarily translate into greater gains in CQ during international mobility. On the contrary, significant gains on the E-CQS variables are typically observed among students who are less open, less extraverted, or have less prior intercultural exposure. This finding reinforces the idea that long-term international mobility plays a crucial role in enhancing CQ among a diverse student population, particularly benefiting those who need it most. Such insights underscore the importance of further exploring the nuanced pathways of CQ development during international mobility and offer practical recommendations for designing programs that maximize participants' CQ growth and global readiness.

CRedit authorship contribution statement

Chédru Marie: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ostapchuk Mariia:** Writing – review & editing, Validation, Software, Methodology, Formal analysis, Conceptualization.

Declaration of Competing Interest

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.ijintrel.2025.102180](https://doi.org/10.1016/j.ijintrel.2025.102180).

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