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| RESEARCH ARTICLE

Foreign Language Learning Enhances Cognitive flexibility, which Facilitates Reported Perspective-taking: Evidence from PISA 2018

Bo Yang
Department of Psychology, Guangxi Normal University, Guilin, 541004
Corresponding Author: Bo Yang, **E-mail**: youngpsy@163.com

| ABSTRACT
Multilingual speakers have often been found to be superior in taking another person's perspective. Also, females are commonly found to have enhanced perspective-taking (PT) abilities compared with males, with male PT being generally more easily affected by external factors. Research on bilingual advantages has been widely verified in children, adults, and the elderly. However, few researchers have paid attention to the bilingual advantages and perspective-taking in adolescents. Perspective-taking skills are often associated with positive behaviors such as prosocial behavior and understanding others. In this study, we used a large and representative sample derived from the 2018 PISA survey to examine the relationship between bilingual experience, perspective-taking, and cognitive flexibility. The moderating effect of cultural individualism was also analyzed. The results of multi-level structural equation modeling (MSEM) indicate that: (1) foreign language learning is positively associated with perspective-taking and cognitive flexibility after controlling for individual-level and country-level demographic variables; (2) cognitive flexibility mediated the association between foreign language learning and perspective-taking; (3) the moderating effect of cultural individualism is significant. Specifically, in collectivist (vs. individualist) countries/societies, there is a stronger association between foreign language learning and perspective-taking.

| KEYWORDS

Foreign language learning, Perspective-taking, cognitive flexibility, PISA 2018, Individualism.

| ARTICLE INFORMATION

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1. Introduction

With increasing globalization, the importance of learning foreign languages has gradually come to the fore; whether for personal development, job competition, or international exchange and cooperation, it is very necessary and important to have fluency and good language skills. Within this trend, bilingualism is on the rise; in the United States, for example, 20.7% were bilingual between 2009 and 2013, compared to 9.6% in 1980. According to the World Resources Institute, bilinguals make up 35% of the world's population. Researchers have also concentrated on how language acquisition affects a person's cognitive development, particularly how multilingualism affects cognitive control. The bilingual cognitive advantage effect refers to the observation made by researchers that bilinguals exhibit specific benefits over monolinguals in non-verbal domains such as working memory, conflict resolution, and cognitive flexibility. Numerous studies have demonstrated that bilinguals display specific advantages in cognitive control at varying age stages. Kovacs and Mehter investigated the effects of different language environments on 7-month-old infants and showed that bilingual developmental environments accelerated the development of inhibitory and transformational skills (Kovács & Mehler, 2009). Bialystok found that bilingual children outperformed monolingual children in inhibitory control and selective attention using a word size judgment task and a tessellation task (Bialystok, 1992). Research suggests that bilingualism promotes the development of cognitive flexibility in children using the Wisconsin Card Sorting Task (Adi-Japha et al., 2010). Bialystok and his associates compared young and old subjects with different numbers of languages using the Simon task and showed that young and old bilinguals showed some inhibitory control advantage and that the cognitive advantage effect of

bilingualism was more pronounced in old age (Bialystok et al., 2004).Therefore we cannot study the brain cognitive mechanisms of bilingual learning solely, but go further and study the social cognitive impact of bilingual learning, such as Perspective-taking.

Perspective-taking refers to the ability to represent the knowledge state of another person. It has applications in realms as diverse as mathematics (e.g., in understanding the geometry of multi-dimensional figures) and language comprehension (by helping to resolve ambiguities); yet, it is not something that always comes naturally. Children may lack the ability to explicitly reason about complex belief states until the age of 4 (Wimmer & Perner, 1983). On the other hand, evidence from implicit, non-verbal tasks demonstrates the ability to reason about false beliefs by 15 months of age(Onishi & Baillargeon, 2005), suggesting that resource rather than representational issues may be in play. Indeed, individual differences in children's inhibitory control predict success in both theory-of-mind tasks (Carlson & Moses, 2001a) and in perspective-taking in conversation. However, existing literature is insufficient to solve controversies over this issue; specifically, due to the lack of representative and large samples, sound conclusions are relatively sparse. Therefore, this study used a dataset derived from the Programme for International Student Assessment (PISA) 2018 to explore the effect of foreign language learning on Perspective-taking.

1.1 Perspective-taking

Perspective-taking (PT) refers to the ability of an individual to infer the internal mental activity of another person, for example, to put oneself in another person's place in order to understand their thoughts, desires, intentions, and feelings (Baron-Cohen, 1988). Perspective-taking (PT) is used in the literature interchangeably with the terms Theory of Mind (ToM), cognitive empathy, and mentalizing, that is, the ability to understand the mental state of oneself or others, e.g. (Christov-Moore et al., 2014; Zaki & Ochsner, 2012). While PT is a more common term in studies that rely on self-report measures, ToM is a term often adopted in experimental studies. The ability of individuals to de-center and put themselves on the perspectives of others, which means "synoptic thinking", is the essence of perspective-taking. For example, if I have a question about math, it is important that I ask someone whom I believe knows about math and not someone who does not know about math. Doing so requires distinguishing between knowledge that is privately held by one member of the conversation (termed ''privileged ground'') from knowledge that is jointly known, termed the ''common ground''.

Stronger PT abilities are generally associated with positive features. For instance, higher PT skills are related to better social functioning and higher self-esteem (M. H. Davis, 1983). PT skills also predict the size of a person's social network (Stiller & Dunbar, 2007), and higher PT scores have significant implications for children's peer relationships, which means children with heightened PT skills are more popular among their peers (Slaughter et al., 2015). Furthermore, better PT abilities can improve the development of prosocial behavior (Schroeder, 2018), and individuals' propensity toward PT is related to altruistic behavior (Anita et al., 2016). On a societal level, individuals with better PT skills more easily suppress automatic expressions of racial bias, contributing to a reduced intergroup bias (Todd et al., 2011). Similarly, Hemer suggested students' openness to diversity and challenge and their participation in high-impact practices (e.g., diversity courses and service-learning) were also positively related to the development of perspective-taking (Hemer et al., 2019). It has, therefore, been argued that developing PT in citizens is crucial for cultivating a civic identity and building a diverse democratic society.

Although PT is invariably associated with positive features, there is a "dark" side, which is seldom discussed. On an interpersonal level, there is increasing evidence that high emotional intelligence can be successfully used for morally questionable purposes, such as manipulating, deceiving, or harming others when paired with "dark" personality traits such as Machiavellianism (which reflects a duplicitous and manipulative interpersonal style) and psychopathy (Grieve & Mahar, 2010). On an intrapersonal level, individuals with high EI seem to be more vulnerable to anxiety and depressive symptoms in stressful situations, for example, when watching a distressing film, after completing a very difficult cognitive task, or when experiencing economic deprivation (Davis & Humphrey, 2012). It may be that an excessive awareness of one's emotions, particularly negative ones, can amplify the effects of stressors, leading to worse mental health. Ding and his colleague reported more dishonest behaviors among children who were trained in ToM (Ding et al., 2015). Therefore, while overall higher PT is associated with many positive outcomes, there may be a certain level of PT that is beneficial, with either very high or very low levels of PT having negative effects.

1.2 Foreign language learning and Cognitive flexibility

How foreign language learning and bilingual experiences affect an individual's cognitive control is a hot issue in the academic community. Foreign language learning involves experience in switching between languages, which monolinguals do not have. Cognitive switching ability is the ability of individuals to switch between different cognitive tasks or states of mind in response to situational changes, and it has also been referred to in previous literature as switching ability, mental set shifting, or cognitive flexibility. In this paper, we refer to cognitive switching ability as cognitive flexibility for consistency.

In foreign language learning, we generally use the first language as an auxiliary, which involves language-switching. When learning a new language, individuals may associate word meanings with their first language, a process known as language-switching.

Language-switching costs are cited as evidence for the continuous activation of both languages in bilingual speakers and the need to inhibit one language in order to allow output in the other (Meuter & Allport, 1999); language switching is more than just a cost. It also facilitates the development of cognitive flexibility, which is an important difference between foreign language learners and monolingual. Several studies have revealed neural mechanisms for language switching that somewhat intersect with general tasks (De Baene et al., 2015; Weissberger et al., 2015). Thus, long-term experiences of switching between languages may improve cognitive flexibility in foreign language learning. Several empirical studies have been carried out by scholars in response to this hypothesis. For example, Prior and her colleagues compared the performance of monolingual and fluent bilingual college students in a task-switching paradigm, suggesting that lifelong experience in switching between languages may contribute to increased efficiency in the ability to cognitive flexibly (Prior & Gollan, 2011; Prior & Macwhinney, 2010). Besides behavioral experiments, bilinguals and monolinguals exhibit differences in brain activity and structure. Hence, foreign language learning has the potential to result in variations in neural mechanisms. For example, van de Putte and colleagues used fMRI to compare the performance of the two groups before and after being trained to perform a color-shape switch task and found that, at the functional level, bilinguals showed an increase in activation in the right angular gyrus and the left superior temporal gyrus in two non-verbal cognitive control tasks (the Simon task and a color-shape switch task), relative to the translators (Van de Putte et al., 2018). Kuipers and Thierry used ERP to investigate the differences between monolingual and bilingual toddlers in their semantic processing efficiency and their allocation of attention to anticipated and unexpected visual stimuli and found that unexpected visual stimuli facilitated bilingual children's semantic processing ability, which suggests that bilingual children notice new stimuli faster than monolingual children, i.e., higher cognitive flexibility (Kuipers & Thierry, 2013).

1.3 Cognitive flexibility and perspective-taking

A central question in language research is the extent to which linguistic behavior reflects the mechanisms of a particular language or general domain. In the case of perspective-taking, executive function (EF) is thought to play a role in inhibiting privileged information when considering commonalities. Some studies have shown that differences in inhibitory control and working memory predict perspective-taking in communication (Brown-Schmidt, 2009; Lin et al., 2010), while others have failed to replicate these patterns (Brown-Schmidt & Fraundorf, 2015; Ryskin et al., 2015; Ryskin et al., 2014). From the literature review, the positive relationship between executive functions and perspective-taking has been widely documented from childhood to old age. For instance, several researchers suggested that EF development is a necessary requirement for successful perspective-taking acquisition, independent of age and IQ (Carlson & Moses, 2001b; Pellicano, 2007; Perner & Lang, 1999). Compared to children and elderly adults, whose cognitive control exhibits substantial variability, young adults as a group likely operate at peak cognitive capacity, potentially concealing any influence of individual differences. All the aforementioned studies have concentrated on a specific age range and examined just two major executive functions, namely working memory and inhibitory control. However, this is deemed insufficient. Bradford and colleagues used a large sample of 265 community-based participants (aged 20-86 years) to examine changes in perspective-taking abilities – a component of 'Theory of Mind' across adulthood; participants completed a referential communication task (the 'Director' task) whilst behavioral responses and eye movements were recorded, along with four measures of executive functions (inhibitory control, working memory, cognitive flexibility, and planning), and found that cognitive flexibility positively predicts the development of perspective-taking (Bradford et al., 2022). Madeleine and colleagues also investigated the positive relationships between switching ability and perspective-taking in ages (17~84). Little research has explored the relationship between cognitive flexibility and perspective-taking in adolescents.

1.4 Foreign language learning directly and indirectly influences perspective-taking

Based on the above reasoning, this study proposed that foreign language learning influences an individual's perspective-taking indirectly via cognitive flexibility. However, there are other mechanisms not suggested by previous literature but can be tested in this study. They are treated as "direct effect".

First, foreign language learning is an important issue to cultivate perspective-taking because it can enhance cross-cultural understanding and interpersonal competence, including positive attitudes towards other cultures and their people, decreased ethnocentrism, and increased effectiveness in interacting with people of other cultures. Culture influences and shapes language, and language reflects culture, suggesting that cultural knowledge can be integrated into foreign language curricula. Foreign language learning has the potential to (1) deepen the understanding of how people think and feel are affected by social/religious, historical, economic, political, and geographic factors; (2) nurture the awareness that effective interactions partly depend on situational variables (e.g., role expectations, social variables such as gender and social class) (Berdrow, 2009). Previous literature has also suggested psychological mechanisms through which foreign language learning promotes perspective-taking (Tarighat & Krott, 2021). These mechanisms are discussed in the following paragraphs.

Creativity. Foreign language learning paves the way to appreciate different views and perspectives, equipping the learners with more original, elaborate, and flexible ideas (Fürst & Grin, 2021). Foreign language learners are required to transcend conventional logic and cultural idioms of their own; therefore, they are more likely to see the world, express themselves, and solve problems in

diverse ways (Liu et al., 2023). This suggests that multilingualism is associated with greater creativity or open-mindedness (Fürst & Grin, 2021). Creative individuals are interested in new ideas and new people, so they are more willing to embrace diversity and accept other people's values, perspectives, and beliefs.

Empathy. Language conveys a culture's history, values, and wisdom. As the knowledge of another culture accumulates, one develops a deep appreciation of its spiritual and emotional elements. This brings one closer to other races and nationalities and understand their lifestyles, viewpoints, and feelings (Little, 2012). Literature shows that proficient and frequent users of foreign languages have higher levels of open-mindedness and cultural empathy, which reflects the ability to understand the experiences and feelings of people from other cultures (Dewaele & Van Oudenhoven, 2009). It is further suggested that foreign language learning was positively associated with cognitive empathy, the ability to appreciate others' thoughts, beliefs, and affective states (Tiv et al., 2021).

Metalinguistic awareness. Foreign language learning improves metalinguistic awareness, which is a strong predictor of the ability to acquire new languages spoken by people of different races and nationalities (Bialystok et al., 2014). Metalinguistic awareness is the ability to see language as a code and separate it from its symbolic meaning (Chen & Padilla, 2019). The bilinguals have a lexical repertoire that can extend across different languages. Foreign language learning facilitates a deeper understanding of linguistics and grammar (e.g., sentence structures, verb forms, grammar rules, and exceptions), enhancing the ability to understand one's heritage language and learn a new language, which is important for intercultural communication (Nguyen, 2021).

Reduced racial bias. Bilingual children who have increased cognitive flexibility show less racial bias against out-groups compared with monolingual ones (Singh et al., 2020). The monolingual infants were found to respond preferentially to own-race individuals, while the bilinguals showed less discrimination in responding to own-race and other-race individuals (Singh et al., 2021). Because of these benefits of foreign language learning, we conclude that foreign language learning is also beneficial for the development of perspective-taking.

Second, language is a reflection of culture, and learning a foreign language offers an opportunity to gain a deeper understanding of another culture and the way it approaches complex issues. It is not merely the acquisition of a linguistic skill but also an exercise in cultural awareness and sensitivity. From a neurocognitive perspective, foreign language learning requires constant switching between L1 and L2. With increased proficiency, an individual's switching ability improves, leading to greater speed and accuracy when switching perspectives, ultimately enhancing our perspective-taking abilities. Therefore, foreign language learning has an indirect impact on perspective-taking via cognitive flexibility.

While adults overwhelmingly are sensitive to perspective (Hanna et al., 2003), they still show interference from their egocentric perspective. Furthermore, the extent to which adults appreciate perspective is modulated by basic cognitive functions such as working memory and inhibition (Bialystok & Viswanathan, 2009; Lin et al., 2010; Wardlow, 2013). One possible mechanism for the role of inhibitory control is that in order to access a representation of another's perspective, participants must inhibit the prepotent representation of their own perspective. Alternatively, maintaining the relative activation of shared and prepotent items may place high demands on more general attentional monitoring processes.

1.5 The moderating role of culture

Teaching and learning are also affected by culture. In individualist cultures, foreign language learning may be mainly motivated by personal factors (e.g., improving one's ability and competence, finding a better job, and elevating one's social and economic status). In collectivist cultures, social norms prompt individuals to consider the collective good rather than self-interest. This fosters the development of perspective-taking, giving a natural advantage. Contrastingly, in individualistic cultures, self-centered thinking impedes this development. Furthermore, teaching and learning foreign languages are culturally affected in this context.

Based on the above theorizing, we propose that foreign language learning in collectivist (relative to individualist) societies is more strongly associated with GC.

2. This study

We propose that foreign language learning has different effects on perspective-taking in individualist and collectivist societies. Adolescents in collectivist (vs. individualist) societies are strongly bonded to family, are required to conform to social norms and have less freedom to choose their identity. With an emphasis on interpersonal communication, individuals unconsciously adopt a perspective similar to that of others, thereby facilitating their integration into society. It is reasonable to assume that the effects of foreign language learning and cognitive flexibility on perspective-taking also vary by culture.
The following hypotheses were thereupon presented:

H1a: foreign language learning is positively associated with cognitive flexibility.
H1b: foreign language learning is positively associated with perspective-taking.
H2: cognitive flexibility (M) positively mediates the effect of foreign language learning (X) on perspective-taking (Y).
H3a: Individualism (W) moderates the effect of X on M. Specifically, in collectivist (vs. individualist) cultures, foreign language learning more strongly influences cognitive flexibility.
H3b: Individualism (W) moderates the effect of M on Y. Specifically, in collectivist (vs. individualist) cultures, cognitive flexibility more strongly influences perspective-taking.
H3c: Individualism (W) moderates the direct effect of X on Y. Specifically, in collectivist (vs. individualist) cultures, foreign language learning is more likely to facilitate the development of perspective-taking.

We hypothetically constructed a random intercept-random slope multi-level structural equation model (MSEM) to analyze the data (Figure 1). The within-level variables are language, cognitive flexibility, and perspective-taking, while the between-level variable is cultural individualism.

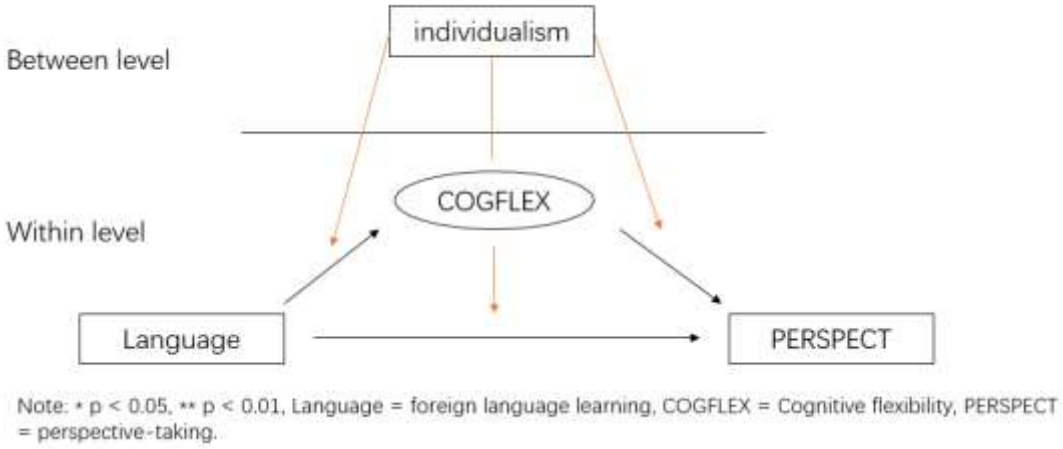

Figure 1. Relationships among research variables

2.1 Data

The data was retrieved from the Programme for International Student Assessment (PISA) 2018 database released by the Organization for Economic Cooperation and Development (OECD), available at: https://www.oecd.org/pisa/data/. The Programme for International Student Assessment (PISA) is a triennial international large-scale assessment organized and administrated by the OECD since 2000, mainly focusing on 15-year-old students who are close to completing compulsory education and have acquired the knowledge and skills essential for full participation in modern societies. Measures were administered to students, school principals, parents, and teachers to assess different aspects of adolescents' development (OECD, 2019).

A total of 346679 students (Mage = 15.79 years, SD = 0.29) from 65 countries/regions completed questionnaires pertaining to this study, including 179,066 girls (51.65%) and 167,613 boys (48.35%).

2.2 Measures

2.2.1 Foreign Languages Learning

It is a dimension of foreign language proficiency or multilingualism, reflecting self-perceived competence in using a foreign language (Dewaele & Wei, 2012). In PISA 2018, the number of foreign languages mastered are measured by Q1 (its variable name is ST177Q01HA in PISA 2018) and Q2 (its variable name is ST189Q01HA in PISA 2018). Q1 asks how many languages the students speak well enough to converse with others (1 = one, 2 = two, 3 = three, 4 = more). Q2 asks how many foreign languages the participants learned at school this school year (0 = zero, 1 = one, 2 = two, 3 = three, 4 = more). In this study, we recorded Q1 (1= one, 2 = two or more) and Q2 (0 = zero, 1 = one or more) and took their total score. In this study, Cronbach's alpha was 0.45.

2.2.2 Cognitive flexibility

In PISA 2018, cognitive flexibility/adaptability is measured by Q1 (its variable name is ST216Q01HATA in PISA 2018) to Q6 (its variable name is ST216Q06HA in PISA 2018) in this study. These items ask how well does the following describes you, I can deal with unusual situations (Q1), I can change my behavior to meet the needs of new situations (Q2), I can adapt to different situations even when under stress or pressure (Q3), I can adapt easily to a new culture (Q4) When encountering difficult situations with other people, I can think of a way to resolve the situation (Q5), I am capable of overcoming my difficulties in interacting with people from other cultures. (Q6). Responses to these six items are scored on a 5-point scale (1= Very much like me, 2 = Mostly like me, 3 = Somewhat like me, 4 = Not much like me, 5 = Not at all like me). These items are reverse scoring. Cognitive flexibility is based on the IRT, which is a composite of measurement question items designed from a four-point Likert scale and a five-point scale. Cronbach's alpha is 0.867 in this study.

2.2.3 Perspective-taking

Perspective-taking is measured by Q1 (its variable name is ST215Q01HA in PISA 2018) to Q5 (its variable name is ST215Q05HA in PISA 2018) in this study. These items ask how well does the following describe you. I try to look at everybody's side of a disagreement before I make a decision (Q1); I believe that there are two sides to every question and try to look at them both (Q2). I sometimes try to understand my friends better by imagining how things look from their perspective (Q3); before criticizing somebody, I try to imagine how I would feel if I were in their place (Q4); when I'm upset at someone, I try to take the perspective of that person for a while (Q5). Responses to these six items are scored on a 5-point scale (1= Very much like me, 2 = Mostly like me, 3 = Somewhat like me, 4 = Not much like me, 5 = Not at all like me). These items are reverse scoring. Perspective-taking is based on the IRT, which is a composite of measurement question items designed from a four-point Likert scale and a five-point scale. Cronbach's alpha is 0.831 in this study.

2.2.4 Individualism

Derived from Hofstede, Hofstede, & Minkov (2010), the individualism value of each country/society is used as the moderator at the national (between) level in this study. Higher values indicate higher levels of individualism (Hofstede, 1986).

2.2.5 Control variables

This study used self-reported gender (1 = female, 2 = male), immigration status (1 = native, n = 310,617; 2 = second-generation, n = 18,715; 3 = first-generation, n= 17,347), age, grade, and ESCS (Index of economic, social and cultural status) as covariates at the individual level, which are available in 2018 PISA dataset.

3. Results

The skewness and kurtosis of key variables in this study, which were all no larger than 2, indicated conformity with the assumption of univariate normality. A variance inflation factor (VIF) was used to test multicollinearity, which did not exceed 10. Table 2 displays the descriptive statistics and correlations among individual-level variables in the MSEM models (Muthén & Muthén, 2017). Foreign language learning is positively correlated with cognitive flexibility as well as perspective-taking, and cognitive flexibility positively mediated the effect of foreign language learning on perspective-taking. The medication effect accounted for 23.785% of the total effect. The results of the mediation analysis are shown in Figure 2.

Table 2 Descriptive statistics and correlation coefficients of individual-level variables.

	M（SD）	1	2	3	4	5	6	7	8
PERSPECT	0.068 (0.996)	-							
COGFLEX	0.05 (0.997)	.469**	-						
Age	15.794 (0.291)	.017**	.020**	-					
Gender	-	-.119**	.024**	-.000	-				
Language	1.573（0.612）	.053**	.062**	-.010	-.029**	-			
ESCS	-0.284（1.095）	.070**	.132**	-.001	.007**	.162**	-		
IMMIG	1.15（0.480）	.014**	.022**	.019**	.005**	.026**	.058**	-	
Grade	11.48（12.342）	-.004*	-.007	.030**	.007	.047**	.028**	-.001	-

Note. PERSPECT= Perspective-taking, COGFLEX= Cognitive flexibility, Language = foreign language learning, ESCS = Index of economic, social, and cultural status, IMMIG = Index Immigration status; *=p<0.05, ** = p < 0.01.

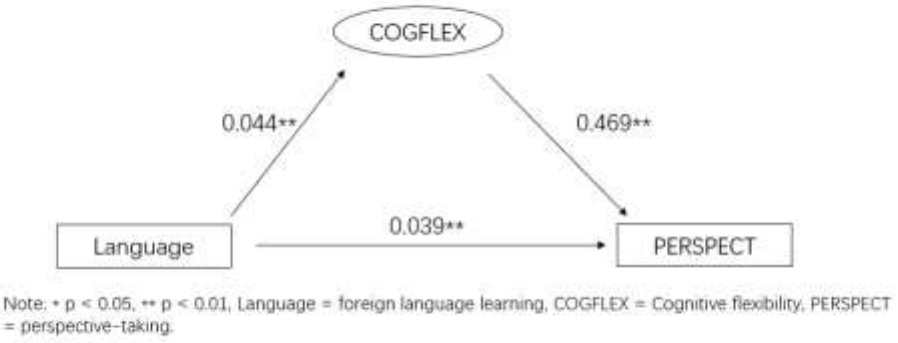

Figure 2. Results of the Mediation Analysis

In the MSEM model, we first analyzed the moderating effect of individualism on the effect of M on X (Table 3). Here, foreign language learning (X), cognitive flexibility (M), and perspective-taking (Y) are level-1 variables. Individualism (W) is used as a moderator at level 2. Perspective-taking (Y) is used both as level 1 and level 2 variables, which shows a significant between-group effect. The results indicated: (1) at level 1, foreign language learning, cognitive flexibility, and age all have significant positive effects on perspective-taking, while gender is negatively associated with perspective-taking; (2) the moderating effect of individualism is insignificant.

Table 3 Moderation effect of individualism on X→M association

	Estimate	S.E.	Est./S.E.	Two-tailed p
Within-group effects (level -1)				
PERSPECT on				
COGFLEX	0.467	0.008	60.087	0.000
Language	0.032	0.007	4.760	0.000
Gender	-0.260	0.008	-31.626	0.000
Age	0.032	0.005	6.021	0.000
IMMIG	0.022	0.004	2.625	0.009
ESCS	0.027	0.004	6.809	0.000
Grade	0.000	0.000	-0.634	0.526
COGFLEX on				
Gender	0.052	0.010	5.428	0.000
Age	0.039	0.008	4.778	0.000
IMMIG	-0.001	0.009	-0.159	0.873
ESCS	0.081	0.007	12.322	0.000
Grade	0.000	0.000	-2.905	0.004
Residual Variances				
PERSPECT	0.742	0.015	49.259	0.000
COGFLEX	0.944	0.024	39.200	0.000
Between-group effects (level -2)				
S on				
Individualism	0.000	0.000	0.193	0.847
PERSPECT on				
Individualism	-0.003	0.001	-3.339	0.001
Residual Variances				
PERSPECT	0.020	0.003	6.214	0.000
S	0.004	0.001	4.314	0.000

Note. IMMIG = Index Immigration status, COGFLEX = cognitive flexibility, PERSPECT = Perspective-taking, Language = number of foreign languages mastered, ESCS = Index of economic, social, and cultural status, S = the slope of M on X.

Second, we analyzed the moderating role of individualism in the second stage of the X→M→Y pathway, namely Y on M (Table 4). Here, foreign language learning (X), cognitive flexibility (M), and perspective-taking (Y) are level-1 variables, and individualism (W) is used as a moderator at level-2. Cognitive flexibility (M) and perspective-taking (Y) have significant between-group effects and are used both as level-1 and level-2 variables. The results indicated: (1) the number of foreign languages mastered, Cognitive flexibility, and age all have significant positive effects on Perspective-taking, while gender is negatively associated with Perspective-taking; (2) the moderating effect of individualism is insignificant.

Table 4 Moderation effect of individualism in M→Y association

	Estimate	S.E.	Est./S.E.	Two-tailed p
Within-group effects (level -1)				
COGFLEX on				
ESCS	0.090	0.007	13.262	0.000
Gender	0.048	0.010	4.821	0.000
IMMIG	0.003	0.008	0.452	0.651
Age	0.038	0.008	4.608	0.000
Grade	0.000	0.000	-0.473	0.636
PERSPECT on				
COGFLEX	0.466	0.008	60.079	0.000
Gender	-0.260	0.008	-31.762	0.000
IMMIG	0.040	0.006	2.628	0.000
Age	0.034	0.005	6.454	0.000
ESCS	0.027	0.004	6.837	0.000
Grade	0.000	0.000	-0.473	0.636
Residual Variances				
PERSPECT	0.741	0.015	49.231	0.000
COGFLEX	0.949	0.024	39.394	0.000
Between-group effects (level -2)				
S on				
Individualism	0.000	0.000	-1.720	0.085
PERSPECT on				
Individualism	-0.003	0.001	-3.338	0.001
Residual Variances				
PERSPECT	0.020	0.003	6.210	0.000
S	0.001	0.000	3.145	0.002

Note. IMMIG = Index Immigration status, COGFLEX = cognitive flexibility, PERSPECT = Perspective-taking, Language = number of foreign language mastered, ESCS = Index of economic, social and cultural status, S = the slope of Y on M.

Third, we examine whether individualism moderates the direct effect (namely Y on X) in our MSEM model (Table 5). Here, foreign language learning (X) and Perspective-taking (Y) are level-1 variables, and individualism (W) is used as a moderator at level-2. perspective-taking (Y) is used as both the level-1 and level-2 variables. The results indicated: (1) at level 1, the number of foreign languages mastered, Cognitive flexibility and age all have significant positive effects on Perspective-taking, while gender is negatively associated with perspective-taking; (2) at level 2, the moderating effect of individualism is significant, suggesting that foreign language learning is more likely to enhance perspective-taking in collectivist (vs. individualist) culture.

Table 5 Moderation effect of individualism in the direct path of X→Y

	Estimate	S.E.	Est./S.E.	Two-tailed p
Within-group effects (level -1)				
PERSPECT on				
Language	0.096	0.007	13.876	0.000
Gender	-0.236	0.010	-24.714	0.000
Age	0.052	0.008	6.781	0.000
IMMIG	0.033	0.009	3.502	0.000
ESCS	0.076	0.006	11.744	0.000
Between-group effects (level -2)				
S on				
Individualism	-0.004	0.002	-2.525	0.012
PERSPECT on				
Individualism	-0.002	0.001	-3.292	0.001
Residual Variances				
PERSPECT	0.031	0.005	6.177	0.000

Note. IMMIG = Index Immigration status, PERSPECT = Perspective-taking, Language = number of foreign language mastered, ESCS = Index of economic, social and cultural status, S = the slope of Y on X.

4. Discussion

The findings highlight the relationship between foreign language learning, cognitive flexibility, and perspective-taking. Moreover, results underscore the importance of communicative perspective-taking for adolescents' social relationships generally.

First, based on previous behavioral and neuroimaging studies, we predicted that there should be universal bilingual advantages in large samples. Perspective-taking, in particular, is challenging for adults (Schober, 2009), even though adults have a lifetime of experience with disparities in viewpoint. In any face-to-face conversation, the speakers never view the world from the same spatial perspective. This difficulty may be because spatial perspective-taking requires the mental transformation of one's viewpoint to match another. Perspective-taking in the conversation has typically been examined in tasks that manipulate what is in the common or privileged visual ground using occlusion. Additionally, several researchers proposed that it is unknown how rapidly such processes guide language comprehension and whether individual differences in cognitive functions, for example, are a mediating factor. Thus, this study examines both the direct association between learning a foreign language and perspective-taking, as well as the mediating role of cognitive flexibility, suggesting that the effect of foreign language learning on cognitive flexibility and perspective-taking may be universal.

Second, there is a trade-off between flexibility and efficiency in the cognitive process of viewpoint selection. Explaining or speculating about the beliefs of others requires both understanding the beliefs and cognitive reasoning. Bilingualism enhances the adolescent's ability to distinguish between phonology and semantics, cultivates awareness of the arbitrary nature of word-referent object relationships, and boosts the development of meta-linguistic awareness. Since bilingual individuals have to continually manipulate two linguistic representations during speech processing and deliberately choose the target language while inhibiting the non-target language based on environmental and pragmatic factors, they attain superior inhibitory control, which enables individuals to precisely comprehend the relevant information and surmount the interference of irrelevant data during speech processing. Bilingual adolescents exhibit heightened sociolinguistic awareness due to their need to select a suitable language, according to the addressee. Furthermore, the automatic activation and competition between the two languages spoken by bilingual individuals have a substantial impact on their inhibitory control and cognitive flexibility. As a result, bilinguals tend to exhibit enhanced inhibitory control and cognitive flexibility, which consequently leads to better executive functioning (i.e., cognitive flexibility and inhibitory control), particularly in situations where frequent code-switching between languages is required. In other words, Bilingual individuals possess executive function strengths that facilitate increased levels of perspective-taking.

5. Strengths and limitations

Using a large and representative sample, this study confirmed the relationship between foreign language learning and perspective-taking, providing evidence that this relationship is not affected by culture. We propose that language is not a collection of grammar and vocabulary; it conveys knowledge, skills, and wisdom of another culture that can broaden the learners' behavioral repertoire and promote the development of perspective-taking. This study also has several limitations.

First, the low reliability of study 1, which is caused by involving too small a number of items measuring foreign language learning, may result in a distorted relationship between the independent and dependent variables. The Programme for International Student Assessment (PISA) 2018 includes only two items asking how many languages the students have learned. Second, we have not explored the effects of different types of foreign languages on perspective-taking. For example, when English is learned as a foreign language, its effect on perspective-taking may be different when Spanish or Chinese is learned as a foreign language. Third, some countries/regions may be overrepresented or underrepresented because the sample sizes are not in proportion to the corresponding populations. Fourth, this study has a large sample size and high reliability. However, cognitive flexibility and perspective-taking are measured by self-reported questionnaires, which is inadequate. Future research could focus on any of these aspects.

6. Conclusion

This study revealed that foreign language learning is positively associated with cognitive flexibility and perspective-taking, suggesting one desirable outcome of foreign language learning, which can even facilitate cognitive skills. We further find the moderating role of culture. In collectivist (vs. individualist) cultures, foreign language learning is more strongly associated with perspective-taking. Therefore, more attention should be paid to the role of foreign language learning in cultivating cognitive abilities. With an increasing endorsement of individualism all over the world, this effect is expected to be larger.

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References

[1] Adi-Japha, E., Berberich-Artzi, J., & Libnawi, A. (2010). Cognitive Flexibility in Drawings of Bilingual Children. *Child Development, 81*(5), 1356-1366. doi:https://doi.org/10.1111/j.1467-8624.2010.01477.x
[2] Anita, T., Anne, B., Philipp, K., Fynn-Mathis, T., & Tania, S. (2016). Decoding the Charitable Brain: Empathy, Perspective Taking, and Attention Shifts Differentially Predict Altruistic Giving. *The Journal of Neuroscience, 36*(17), 4719. doi:10.1523/JNEUROSCI.3392-15.2016
[3] Baron-Cohen, S. (1988). Social and pragmatic deficits in autism: cognitive or affective? *Journal of Autism and Developmental Disorders*.
[4] Berdrow, I. (2009). Designing effective global competence development opportunities. *International Journal of Management in Education*. doi:10.1504/IJMIE.2009.027354
[5] Bialystok, E. (1992). Attentional Control in Children's Metalinguistic Performance and Measures of Field Independence. *Developmental Psychology*. doi:10.1037/0012-1649.28.4.654
[6] Bialystok, E., M, C. F. I., Klein, R., & Viswanathan, M. (2004). Bilingualism, Aging, and Cognitive Control: Evidence From the Simon Task. *Psychology and Aging*. doi:10.1037/0882-7974.19.2.290
[7] Bialystok, E., Peets, K. F., & Moreno, S. (2014). Producing bilinguals through immersion education: Development of metalinguistic awareness. *Applied Psycholinguistics, 35*(1), 177-191. doi:10.1017/S0142716412000288
[8] Bialystok, E., & Viswanathan, M. (2009). Components of executive control with advantages for bilingual children in two cultures. *Cognition, 112*(3), 494-500. doi:https://doi.org/10.1016/j.cognition.2009.06.014
[9] Bradford, E., Brunsdon, V., & Ferguson, H. (2022). Cognitive mechanisms of perspective-taking across adulthood: An eye-tracking study using the director task. *Journal of experimental psychology. Learning, memory, and cognition, 49*. doi:10.1037/xlm0001190
[10] Brown-Schmidt, S. (2009). The role of executive function in perspective taking during online language comprehension. *Psychonomic Bulletin & Review, 16*(5), 893-900. doi:10.3758/PBR.16.5.893
[11] Brown-Schmidt, S., & Fraundorf, S. H. (2015). Interpretation of informational questions modulated by joint knowledge and intonational contours. *Journal of Memory and Language, 84*, 49-74. doi:https://doi.org/10.1016/j.jml.2015.05.002
[12] Carlson, S. M., & Moses, L. J. (2001a). Individual differences in inhibitory control and children's theory of mind. *Child Development*.
[13] Carlson, S. M., & Moses, L. J. (2001b). Individual Differences in Inhibitory Control and Children's Theory of Mind. *Child Development, 1032-53*.
[14] Chen, X., & Padilla, A. M. (2019). Role of Bilingualism and Biculturalism as Assets in Positive Psychology: Conceptual Dynamic GEAR Model. *Frontiers in Psychology, 10*. doi:10.3389/fpsyg.2019.02122
[15] Christov-Moore, L., Simpson, E. A., Coudé, G., Grigaityte, K., Iacoboni, M., & Ferrari, P. F. (2014). Empathy: Gender effects in brain and behavior. *Neuroscience & Biobehavioral Reviews, 46*, 604-627. doi:https://doi.org/10.1016/j.neubiorev.2014.09.001
[16] Davis & Humphrey, N. (2012). Emotional intelligence as a moderator of stressor–mental health relations in adolescence: Evidence for specificity. *Personality and Individual Differences, 52*(1), 100-105. doi:https://doi.org/10.1016/j.paid.2011.09.006
[17] Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*. doi:10.1037/0022-3514.44.1.113
[18] De Baene, W., Duyck, W., Brass, M., & Carreiras, M. (2015). Brain Circuit for Cognitive Control Is Shared by Task and Language Switching. *Journal of Cognitive Neuroscience, 27*(9), 1752-1765. doi:10.1162/jocn_a_00817
[19] Dewaele, J.-M., & Van O, J. P. (2009). The effect of multilingualism/multiculturalism on personality: no gain without pain for Third Culture

Kids? *International Journal of Multilingualism, 6*(4), 443-459. doi:10.1080/14790710903039906
[20] Ding, X. P., Wellman, H. M., Wang, Y., Fu, G., & Lee, K. (2015). Theory-of-Mind Training Causes Honest Young Children to Lie. *Psychological Science, 26*(11), 1812-1821. doi:10.1177/0956797615604628
[21] Fürst, G., & Grin, F. (2021). Multicultural experience and multilingualism as predictors of creativity. *International Journal of Bilingualism, 25*(5), 1486-1494. doi:10.1177/13670069211019468
[22] Grieve, R., & Mahar, D. (2010). The emotional manipulation–psychopathy nexus: Relationships with emotional intelligence, alexithymia and ethical position. *Personality and Individual Differences, 48*(8), 945-950. doi:https://doi.org/10.1016/j.paid.2010.02.028
[23] Hanna, J. E., Tanenhaus, M. K., & Trueswell, J. C. (2003). The effects of common ground and perspective on domains of referential interpretation. *Journal of Memory and Language, 49*(1), 43-61. doi:https://doi.org/10.1016/S0749-596X(03)00022-6
[24] Kovács, Á. M., & Mehler, J. (2009). Cognitive gains in 7-month-old bilingual infants. *Proceedings of the National Academy of Sciences, 106*(16), 6556-6560. doi:10.1073/pnas.0811323106
[25] Kuipers, J.-R., & Thierry, G. (2013). ERP-pupil size correlations reveal how bilingualism enhances cognitive flexibility. *Cortex, 49*(10), 2853-2860. doi:https://doi.org/10.1016/j.cortex.2013.01.012
[26] Lin, S., Keysar, B., & Epley, N. (2010). Reflexively mindblind: Using theory of mind to interpret behavior requires effortful attention. *Journal of Experimental Social Psychology, 46*(3), 551-556. doi:https://doi.org/10.1016/j.jesp.2009.12.019
[27] Little, D. (2012). The European Language Portfolio in whole-school use. *Innovation in Language Learning and Teaching, 6*(3), 275-285. doi:10.1080/17501229.2012.725254
[28] Liu, G., Ma, C., Bao, J., & Liu, Z. (2023). Toward a model of informal digital learning of English and intercultural competence: a large-scale structural equation modeling approach. *Computer Assisted Language Learning*. doi:10.1080/09588221.2023.2191652
[29] Meuter, R. F. I., & Allport, A. (1999). Bilingual Language Switching in Naming: Asymmetrical Costs of Language Selection. *Journal of Memory and Language, 40*(1), 25-40. doi:https://doi.org/10.1006/jmla.1998.2602
[30] Nguyen, M. V. H. W., A. (2021). Early bilingualism predicts enhanced later foreign language learning in secondary school. *Developmental Psychology, 57*(11). doi:10.1037/dev0001248
[31] Onishi, K. H., & Baillargeon, R. (2005). Do 15-Month-Old Infants Understand False Beliefs? *Science, 308*(5719), 255-258. doi:10.1126/science.1107621
[32] Pellicano, E. (2007). Links Between Theory of Mind and Executive Function in Young Children With Autism: Clues to Developmental Primacy. *Developmental Psychology, 43*, 974-990. doi:10.1037/0012-1649.43.4.974
[33] Perner, J., & Lang, B. (1999). Development of theory of mind and executive control. *Trends in Cognitive Sciences, 3*, 337-344. doi:10.1016/S1364-6613(99)01362-5
[34] Prior, A., & Gollan, T. H. (2011). Good Language-Switchers are Good Task-Switchers: Evidence from Spanish–English and Mandarin–English Bilinguals. *Journal of the International Neuropsychological Society, 17*(4), 682-691. doi:10.1017/S1355617711000580
[35] Prior, A., & Macwhinney, B. (2010). A bilingual advantage in task switching. *Bilingualism: Language and Cognition, 13*(2), 253-262. doi:10.1017/S1366728909990526
[36] Ryskin, R., Benjamin, A., Tullis, J., & Brown-Schmidt, S. (2015). Perspective-Taking in Comprehension, Production, and Memory: An Individual Differences Approach. *Journal of experimental psychology. General, 144*. doi:10.1037/xge0000093
[37] Ryskin, R., Brown-Schmidt, S., Canseco-Gonzalez, E., Yiu, L., & Nguyen, E. (2014). Visuospatial perspective-taking in conversation and the role of bilingual experience. *Journal of Memory and Language, 74*, 46–76. doi:10.1016/j.jml.2014.04.003
[38] Schober, M. F. (2009). 233 Spatial Dialogue between Partners with Mismatched Abilities. In *Spatial Language and Dialogue* (pp. 0). doi:10.1093/acprof:oso/9780199554201.003.0003
[39] Singh, L., Moh, Y., Ding, X., Lee, K., & Quinn, P. C. (2021). Cognitive flexibility and parental education differentially predict implicit and explicit racial biases in bilingual children. *Journal of Experimental Child Psychology, 204*, 105059. doi:https://doi.org/10.1016/j.jecp.2020.105059
[40] Singh, L., Quinn, Qian, & Lee. (2020). Bilingualism is associated with less racial bias in preschool children. *Developmental Psychology, 56*(5). doi:10.1037/dev0000905
[41] Slaughter, V., Imuta, K., Peterson, C. C., & Henry, J. D. (2015). Meta-Analysis of Theory of Mind and Peer Popularity in the Preschool and Early School Years. *Child Development, 86*(4), 1159-1174. doi:https://doi.org/10.1111/cdev.12372
[42] Stiller, J., & Dunbar, R. I. M. (2007). Perspective-taking and memory capacity predict social network size. *Social Networks, 29*(1), 93-104. doi:https://doi.org/10.1016/j.socnet.2006.04.001
[43] Tarighat, S., & Krott, A. (2021). Bilingualism Enhances Reported Perspective Taking in Men, but Not in Women. *Frontiers in Psychology, 12*. doi:10.3389/fpsyg.2021.679524
[44] Tiv, M., O'Regan, E., & Titone, D. (2021). In a bilingual state of mind: Investigating the continuous relationship between bilingual language experience and mentalizing. *Bilingualism: Language and Cognition, 24*(5), 918-931. doi:10.1017/S1366728921000225
[45] Todd, A. R., Bodenhausen, G. V., Richeson, J. A., & Galinsky, A. D. (2011). Perspective taking combats automatic expressions of racial bias. *Journal of personality and social psychology*. doi:10.1037/a0022308
[46] Van de Putte, E., De Baene, W., García-Pentón, L., Woumans, E., Dijkgraaf, A., & Duyck, W. (2018). Anatomical and functional changes in the brain after simultaneous interpreting training: A longitudinal study. *Cortex, 99*, 243-257. doi:https://doi.org/10.1016/j.cortex.2017.11.024
[47] Wardlow, L. (2013). Individual differences in speakers' perspective taking: The roles of executive control and working memory. *Psychonomic Bulletin & Review, 20*(4), 766-772. doi:10.3758/s13423-013-0396-1
[48] Weissberger, G. H., Gollan, T. H., Bondi, M. W., Clark, L. R., & Wierenga, C. E. (2015). Language and task switching in the bilingual brain: Bilinguals are staying, not switching, experts. *Neuropsychologia, 66*, 193-203. doi:https://doi.org/10.1016/j.neuropsychologia.2014.10.037
[49] Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition, 13*(1), 103-128. doi:https://doi.org/10.1016/0010-0277(83)90004-5
[50] Zaki, J., & Ochsner, K. N. (2012). The neuroscience of empathy: progress, pitfalls and promise. *Nature Neuroscience, 15*(5), 675-680. doi:10.1038/nn.3085