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The structural relations of self-control, empathy, interpersonal trust, friendship quality, and mental well-being among adolescents: a cross-national comparative study in China and Canada

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The aim of the present study was to explore the structural relationships between self-control, empathy, interpersonal trust, friendship quality, and mental well-being among Chinese ($N = 3595$) and Canadian ($N = 2056$) adolescents. A structural equation modeling (SEM) approach was adopted by means of a multi-group analysis. Within the aggregate sample, empathy and interpersonal trust were shown to be related to mental well-being both directly and indirectly, with friendship quality as the mediating variable, whereas self-control merely had a direct effect on mental well-being. The multiple-group analysis revealed a series of discrepancies, showing that empathy had a significant impact on the mental well-being of Chinese but not Canadian adolescents. Furthermore, empathy exerted a significantly stronger effect on friendship quality for Chinese than for Canadian adolescents, whereas interpersonal trust had a significantly stronger impact on friendship quality among Canadian than among Chinese adolescents. The differences were discussed from a cross-cultural perspective concerning collectivism versus individualism. The measures employed in the present study are closely related to social and emotional skills; the findings therefore may point to benefits for both Chinese and Canadian adolescents in terms of enhancement of their cultural-specific social and emotional skills as well as their well-being.

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Introduction

Within the burgeoning discipline of positive psychology, scholars are increasingly interested in exploring mental well-being (Boals et al. 2011; Gokalp 2023; Jakovljevic 2018; Ryan and Deci 2001). Mental well-being refers to a dynamic state of positive emotional and psychological functioning (Ryan and Deci 2001), which comprises individuals' capabilities to develop their potential, perform productively and creatively, build favorable interpersonal relationships, and contribute to their communities (Kirkwood et al. 2008). Mental well-being has been shown to be beneficial for physical health, psychological resilience, supportive relationships, and social interactions (Diener et al. 2018; Kirkwood et al. 2008; Miething et al. 2017) and is therefore highly significant for individuals.

Much research has revealed that individuals' mental well-being is closely relevant to their interpersonal relationships (Clarke et al. 2021; Wei et al. 2011; Zaki 2020). Furthermore, self-control, empathy, and interpersonal trust, which are crucial factors underlying interpersonal relationships, have been proven to be strong contributors to mental well-being (e.g., Betts and Rotenberg 2007; Gokalp 2023; Hecht et al. 2022; Kim et al. 2012); and friendship quality has also been shown to be the predominant interpersonal-related element of those factors that positively affect psychological experience and mental well-being (Chen et al. 2004; van der Horst and Coffé 2011; Zhou et al. 2020). Research on the associations among adolescents' social and emotional skills, interpersonal relationships, and well-being has been prevalent in recent years (Collie 2022; Durlak et al. 2011; Miyamoto et al. 2015). However, the effects of three fundamental social and emotional skills, that is, self-control, empathy, and trust, on interpersonal relationships (e.g., friendship quality) and well-being have rarely been discussed among Chinese and Canadian adolescents (OECD 2019, 2021).

Critically, the above-mentioned social-emotional-related variables have culturally specific meanings. Trust is prone to be strongly promoted by individualism as in Canada (Guo et al. 2022; van Hoorn 2015), whereas empathy and self-control are considered to be more predominant for collectivism as in China (Heinke and Louis 2009; Seeley and Gardner 2003). As opposed to individualist people who emphasize the personal side of friendships, collectivist people view friendship as a means for integration into the wider societal system (Gummerum and Keller 2008). Also, researchers have shown that self- and interpersonal-related factors exert distinct influences on well-being according to individualist versus collectivist context (Guo et al. 2022; Jasielska et al. 2018; Park and Huebner 2005). Thus, in consideration of such underlying cultural differences, a cross-national comparative study designed to improve social-emotional educational practices and mental well-being for Chinese and Canadian adolescents would appear to be very worthwhile.

Literature review

Self-control and mental well-being. As the core component of self-regulation, self-control involves a series of goal-directed competencies that are said to regulate personal thoughts, attitudes, emotions, and behaviors (Carver and Scheier 1981; de Ridder et al. 2012). Self-control reflects individuals' propensity to facilitate goal realization and conquer goal-disruptive desires (de Ridder and Gillebaart 2017). Numerous studies have confirmed the positive relationship between self-control and mental well-being (e.g., Boals et al. 2011; Converse et al. 2018; Gokalp 2023; Hofmann et al. 2014; Kim et al. 2022). More importantly, researchers have identified how the mechanism operates. Emphasizing the key role of purposeful manners, Hofmann et al. (2014) demonstrated that individuals with higher self-control are

less likely to experience conflicting goals in various life domains. Similarly, de Ridder and Gillebaart (2017) found that self-control contributes to people's well-being by activating adaptive behaviors (e.g., goal-directed means) and impeding maladaptive behaviors (e.g., goal-disruptive temptations). Furthermore, research suggests not only that self-control is positively correlated with mental health and psychological resilience (Gokalp 2023) but also that individuals who have low self-control have low mental well-being (Kim et al. 2022) because they are more likely to adopt unhealthy coping strategies (e.g., avoidance coping) which may lead to low levels of mental health (Boals et al. 2011).

The extant large body of research has primarily examined the effect of self-control on adolescents' mental well-being regarding the overcoming of undesirable problems, with self-control as a mediator or moderator. These problems have included excessive internet use, electronic game disorder, academic alienation, parent-child conflict, tolerance deviance, sleep quality, and emotional dysregulation, as well as other internalizing and externalizing symptomatology (e.g., Li et al. 2021; Wills et al. 2016). Fewer studies concerning positive functioning (e.g., friendship quality) have shown a connection between self-control as the potential predictor and the mental well-being of adolescents. Developmental changes regarding the association between self-control and mental well-being occur during adolescence (Kim et al. 2022). More than that, a longitudinal study conducted by Converse et al. (2018) indicated that various positive outcomes linked to self-control during adolescence may underlie ensuing success and longer-term well-being in young adulthood.

Empathy and mental well-being. Empathy is viewed as the capacity to take another's perspective and experience the consequent thoughts and emotions (Davis, 1996; Stewart et al. 2015). The relationship between empathy and personal mental well-being is increasingly a key focus of research (Hecht et al. 2022; Jakovljevic 2018; Wei et al. 2011; Zaki 2020). Jakovljevic's (2018) research suggests that empathy, such as in the demonstration of love, kindness, and compassion in interpersonal communications, enhances individuals' confidence and sense of coherence, thereby causing greater resilience and mental well-being. Wei et al. (2011) argued that empathic individuals generally have higher well-being levels: When people show empathy towards other people, the latter are more likely to feel grateful and act kindly in response. Such a friendly and supportive connection heightens the happiness, life satisfaction, and positive emotions of empathizers (Huang et al. 2018; Wei et al. 2011). Furthermore, it has been found that empathy can alleviate individuals' mental ill-being, for example, their depressive symptoms (Schreiter et al. 2013).

Zaki (2020) demonstrated how empathy heightens peoples' mental well-being through emotion regulation which concerns a goal-related process and which occurs when individuals appraise a shared emotional state. It has been found that through social interactions, people regulate their own emotions and also affect others' emotions, and that reciprocal empathic concern reflects individuals' successful social relationships and mental well-being (Stewart et al. 2015; Zaki 2020). With an emphasis on the destigmatizing effects of empathy, the findings by Hecht et al. (2022) revealed that empathy and reflectiveness are protective factors in the reduction of individuals' mental health stigmas, thereby enhancing mental well-being. Specifically, empathic accuracy, that is, the extent to which people can reckon others' inferences and preferences, exerts a stronger influence than reflectiveness on relationship satisfaction (Sened et al. 2017). Accurately perceiving and assessing the emotional states of peers

may be beneficial for individuals' life satisfaction, close interpersonal relationships, and even a functioning society (Huang and Su 2014; Sened et al. 2017; Wei et al. 2011).

Interpersonal trust and mental well-being. According to Rotter (1967), interpersonal trust concerns an expectancy held by an individual that the promise or statement of another individual can be relied on, and reflects individuals' willingness to be vulnerable to others based on the assumption that these others will perform beneficial and favorable actions (Mayer et al. 1995). Interpersonal trust increases throughout life and makes for support, comfort, and pleasure from others, and is conducive to an extensive social circle, salutary health, and a high-quality life (Poulin and Haase 2015; van Hoorn 2015). Many studies confirm a positive relationship between interpersonal trust and mental well-being (e.g., Clarke et al. 2021; Helliwell and Wang 2011; Kim et al. 2012; Martinez et al. 2019; Miething et al. 2017). Martinez et al. (2019) noted that low interpersonal trust and high depression are indicative of personal distress, and Clarke et al. (2021) demonstrated in a review study that interpersonal trust tends to bring about an improved quality of reciprocal communications and also a decrease in the potential of mental illness. Using data from the Gallup World Poll and the Canadian General Social Survey, Helliwell and Wang (2011) revealed that reciprocal trust relationships, as vital components of social capital, can facilitate individual life evaluation and satisfaction. Furthermore, the bidirectional interdependence between friendship trust and psychological well-being was observed in the population of late adolescence to early adulthood by Miething et al. (2017).

Recently, scholars have explored underlying individual uniqueness in profiles of trust and well-being, using multidimensional and comprehensive cases of cross-cultural differences (Guo et al. 2022; Luo et al. 2023; Zhang 2020). For instance, employing 13,823 samples across 15 nations, Luo et al. (2023) revealed how greater similarities in national interpersonal trust profiles occur in countries that exhibit more similar tightness-looseness propensities in the prevailing social ethos. The authors also showed that, for loose rather than tight cultures, greater individual life satisfaction is predicted by a higher degree of similarity between individuals' and society's trust profiles (Luo et al. 2023). Likewise, Guo et al. (2022) pointed out that individualism may enhance the association between trust and well-being, and that interpersonal trust in collectivist societies probably derives from adherence to social norms rather than personal predilections. These findings support the view that mental well-being depends on subject preferences, particular values, and social beliefs, all of which are related to specific cultural contexts (Diener et al. 2018; Jasielska et al. 2018; Park and Huebner 2005; Zhang 2020).

Friendship quality as the potential mediator. Friendship is viewed as the symbol of high-quality interpersonal relatedness, with understanding, sharing, intimacy, loyalty, and authenticity as its core components (Chen et al. 2004; Gummerum and Keller 2008). Studies have revealed a positive correlation between friendship quality and mental well-being. For example, Zhou et al. (2020), employing the China Education Panel Survey (CEPS), argued that both cross-gender and cross-hukou-location friendships are positively associated with Chinese adolescents' positive mental health and psychological well-being. Similarly, a Canadian case indicated that more personal contact and greater friendship heterogeneity bring about better social support and less psychological stress, and also ameliorative poor mental health states (van der Horst and Coffé 2011). Conversely, friendship conflicts may lead to depression, anxiety, and stress, all of which are

detrimental to the global mental well-being and psychological experience of adolescents (Kong et al. 2022).

Theoretically and empirically, many internal and external factors are relevant to interdependent friendships (Akers et al. 1998; Betts and Rotenberg 2007; van den Bedem et al. 2019). Betts and Rotenberg (2007) confirmed that high self-control promotes peer trustworthiness, which in turn may be a facilitator for peer acceptance and improved school adjustment. Conversely, low self-control is more likely to induce friendship conflicts and reduce the quality of adolescent friendships (Boman et al. 2019). Adopting a criminological perspective, Boman et al. (2012) argued that low attachment, trustworthiness, and self-control may imbue friendships with coldness and brittleness. On the other hand, studies have demonstrated the positive effect of empathy on friendship quality (e.g., Ciarrochi et al. 2017; van den Bedem et al. 2019), and a longitudinal case has identified the bidirectional relationship between empathy and friendship quality in adolescence (van den Bedem et al. 2019). Therefore, according to the literature we have discussed, it may be proposed that friendship quality mediates the potential relationships between self-control and mental well-being, between empathy and mental well-being, and between interpersonal trust and mental well-being.

The present study. This study attempts to explore how self-control, empathy, and interpersonal trust influence adolescents' mental well-being, with friendship quality as a potential mediator. Self-control, empathy, and interpersonal trust are three crucial elements of social and emotional skills (OECD 2021). The potential relationships among these variables have been infrequently examined in the contexts of China and Canada, which demonstrate the cultural values of collectivism and individualism, respectively (Chen et al. 2004; Rubin et al. 2006). Within educational discourse, although single-country samples have largely been used in extant studies that investigate social-emotional skills and well-being, cross-cultural research on these issues from the perspective of comparative education appears to be worthwhile. Potentially, such research would not only provide empirical evidence for various countries regarding enhancing their educational practices but would also achieve deeper global understandings, a fundamental for comparative education (Bray et al. 2014).

Based on existing evidence in the literature, four hypotheses were formulated as follows.

H₁: Self-control (a), empathy (b), and interpersonal trust (c) are each positively associated with friendship quality.

H₂: Friendship quality is positively associated with mental well-being.

H₃: Self-control (a), empathy (b), and interpersonal trust (c) are each positively associated with mental well-being.

H₄: Self-control (a), empathy (b), and interpersonal trust (c) are each positively associated with mental well-being via friendship quality.

The following hypotheses were formulated to verify whether China and Canada differ in terms of the potential relationships displayed in Fig. 1.

H₅: The variable of the country will have some moderating effects on relationships between (a) self-control and friendship quality, (b) empathy and friendship quality, (c) interpersonal trust and friendship quality, (d) friendship quality and mental well-being, (e) self-control and mental well-being, (f) empathy and mental well-being, and (g) interpersonal trust and mental well-being.

Gender and socioeconomic status (SES) were incorporated as covariates in the current model. On the one hand, these variables have been widely used in this way to ensure the unbiasedness of

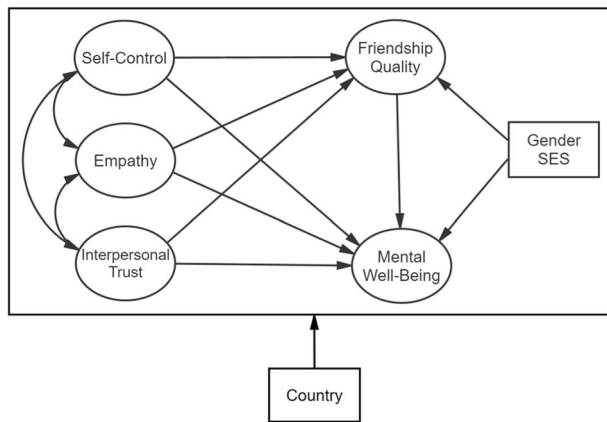


Fig. 1 Hypothesized model (gender and SES are covariates; SES social economic status).

results in social sciences research (Bernierth and Aguinis 2016). On the other hand, they are theoretically and empirically relevant to friendship quality and mental well-being according to previous studies (Akers et al. 1998; Ciarrochi et al. 2017; Lwasaki 2023; Oberle et al. 2010; Zhou et al. 2020).

Methodology

Data sources. The data of the current study were obtained from the 2019 Survey on Social and Emotional Skills (SSES 2019), a large-scale project conducted by the Organization for Economic Co-operation and Development (OECD). SSES 2019 involved more than 60,000 students from 10 cities across nine countries and explored potential characteristics and contextual factors regarding students' social and emotional skills (OECD 2019). The survey assessed variables covering personal characteristics, psychological traits, emotional discrepancies, and interpersonal relationships (e.g., mental well-being, self-control, empathy, trust, as well as perceived relationships with friends), over two cohorts: 10-year-old (the younger cohort) and 15-year-old (the older cohort) students. The age range in the younger cohort was 10.7–10.9 years and in the older cohort, 15.6–16 years (OECD 2021). A two-stage stratified probability sampling design (sampling schools at the first stage and students at the second stage) was administered to gain a representative sample for each participating country (OECD 2021). The present study employed a cross-sectional design, using student questionnaires administered in Suzhou (China) and Ottawa (Canada). Specifically, the samples, both of which were taken from the 15-year-old cohort, contained 3595 students (boys, $N = 1841$; girls, $N = 1754$) from 76 schools in Suzhou, and 2056 students (boys, $N = 1038$; girls, $N = 1018$) from 62 schools in Ottawa. Informed consent for each of the participants in the study had been officially gained by the international organization OECD.

Measures

Self-control. Self-control (SEL) was comprised of six items in the student assessment final scales. However, one indicator with low item-to-construct loadings was eliminated in order to improve reliability as well as purify the measurement model (Anderson and Gerbing 1988; Bollen 1989). The final scale incorporated five items: (a) Can control my actions, (b) Think carefully before doing something, (c) Avoid mistakes by working carefully, (d) Stop to think before acting, and (e) Often rush into action without thinking. All indicators were assessed with a Likert-type format with ratings from 1 to 5, respectively, as follows: “strongly disagree”, “disagree”, “neither agree nor disagree”, “agree”, and

“strongly agree”. Higher scores represented better self-control. Cronbach's $\alpha = 0.76$.

Empathy. Empathy (EMP) incorporated six items within the student assessment final scales, but two items with low item-to-construct loadings were eliminated in the current study (Anderson and Gerbing 1988; Bollen 1989). The four indicators were (a) Can sense how others feel, (b) Know how to comfort others, (c) Understand what others want, and (d) Warm toward others. All indicators were assessed with a Likert-type format with ratings from 1 to 5, respectively, as follows: “strongly disagree”, “disagree”, “neither agree nor disagree”, “agree”, and “strongly agree”. Higher scores indicated more empathy. Cronbach's $\alpha = 0.70$.

Interpersonal trust. Interpersonal trust (TRU) included six items within the student assessment final scales, but one item with low item-to-construct loadings was eliminated in the present study (Anderson and Gerbing 1988; Bollen 1989). The final scale contained five items: (a) Believe that my friends can keep my secrets, (b) Distrust people, (c) Believe that other people will help me, (d) Believe that most people are honest, and (e) Trust others. All indicators were assessed with a Likert-type format with ratings from 1 to 5, respectively, as follows: “strongly disagree”, “disagree”, “neither agree nor disagree”, “agree”, and “strongly agree”. Higher scores showed more interpersonal trust. Cronbach's $\alpha = 0.83$.

Friendship quality. Friendship quality (FRQ) was measured by perceived relationships with friends. Four items, as follows, indicated to what extent students perceived their friendship level: (a) My friends understand me, (b) My friends accept me as I am, (c) My friends are easy to talk to, and (d) My friends respect my feelings. For each item, students were given corresponding response options with a four-point scale: 1 for “Almost never or never true”, 2 for “Sometimes true”, 3 for “Often true”, and 4 for “Almost always or always true”. Higher scores demonstrated better friendship quality. Cronbach's $\alpha = 0.90$.

Mental well-being. Mental well-being (MWB) was assessed by the WHO-5 well-being measure in SSES 2019. Corresponding indices were derived from five well-being-related statements. Students were asked to express how they had been feeling over the past two weeks: (a) Felt cheerful and in good spirits, (b) Felt calm and relaxed, (c) Felt active and vigorous, (d) Woken up feeling fresh rested, and (e) Daily life has been filled with things that interest me. Students were given options on a five-point scale to indicate how often these situations occurred: 1 for “at no time”, 2 for “some of the time”, 3 for “more than half of the time”, 4 for “most of the time”, as well, 5 for “all of the time”. Higher scores embodied more mental well-being. Cronbach's $\alpha = 0.88$.

Analytical procedures. In the current study, the data were analyzed with Mplus 8.3 software (Muthen and Muthen 1998–2019). Confirmatory factor analysis (CFA) and structural equation model (SEM) were estimated by maximum likelihood estimation with the robust standard errors (MLR) method. In order to test for mediation effects, the bootstrapping bias-corrected confidence interval procedure was applied with 10,000 bootstrap samples (Hayes 2009). Furthermore, measurement invariance was used to examine whether the same model fit for China versus Canada, and the multiple-group analysis was used to determine whether the structural paths performed differently for the two countries. Given that the Chi-Square statistic is sensitive to sample size, the model fitness indices used were CFI and TLI with satisfied values more than 0.90, as well as RMSEA and SRMR with accepted

standards less than 0.08 (Bollen 1989; Hooper et al. 2008; Kline 2005).

Results

Descriptive statistics. Table 1 presents descriptive statistics for all study variables, showing that participants from China had a higher mean than Canada on self-control ($M = 3.654$, $SD = 0.432$ for China; $M = 3.514$, $SD = 0.449$ for Canada), empathy ($M = 3.838$, $SD = 0.423$ for China; $M = 3.741$, $SD = 0.572$ for Canada), and interpersonal trust ($M = 3.626$, $SD = 0.669$ for China; $M = 3.214$, $SD = 0.640$ for Canada). However, Canadian participants had higher scores than the Chinese on friendship quality ($M = 3.008$, $SD = 0.587$ for China; $M = 3.174$, $SD = 0.632$ for Canada) and mental well-being ($M = 2.984$, $SD = 0.789$ for China; $M = 2.993$, $SD = 0.814$ for Canada). Regarding the covariates, it was found that the number of males is more than that of females for both Chinese and Canadian participants, and that the Canadian participants had higher SES scores than the Chinese.

Measurement model evaluation. The fit indices of the measurement model for the aggregate sample ($N = 5651$) indicated that $\chi^2 = 2208.324$, $df = 220$, $RMSEA = 0.040$, $CFI = 0.952$, $TLI = 0.945$, and $SRMR = 0.044$, suggesting that the measurement model fit the data adequately (Hooper et al. 2008; Kline 2005). As seen in Table 2, the bivariate correlations for all constructs were significant at the alpha level of 0.001, and the correlation coefficients ranged from 0.213 to 0.512, indicating that further analyses would be appropriate (Kline 2005). Regarding the covariates, both gender and SES were significantly correlated with scores on all constructs, whereas gender and SES were not significantly correlated. Furthermore, as shown in Table 3, the standardized estimates of the items for all constructs, which

ranged from 0.513 to 0.860 were statistically significant at the 0.001 level.

Structural model evaluation. The structural model for the entire sample ($N = 5651$) displayed a satisfactory fit ($\chi^2 = 2640.722$, $df = 262$, $RMSEA = 0.040$, $CFI = 0.945$, $TLI = 0.937$, $SRMR = 0.045$), reflecting that found in previous studies (Hooper et al. 2008; Kline 2005). The results of the structural model evaluation are demonstrated in Fig. 2 and Table 4. Both gender and SES were significantly associated with friendship quality and mental well-being. The findings showed that boys have higher mental well-being whereas girls scored higher in friendship quality, and that participants with higher SES have a higher-quality friendship and more mental well-being. Although self-control ($\beta = -0.011$, $p > 0.05$) had no significant effect on friendship quality, both empathy ($\beta = 0.197$, $p < 0.001$) and interpersonal trust ($\beta = 0.354$, $p < 0.001$) were positively linked to friendship quality. Also, friendship quality ($\beta = 0.151$, $p < 0.001$), self-control ($\beta = 0.117$, $p < 0.001$), empathy ($\beta = 0.085$, $p < 0.001$), and interpersonal trust ($\beta = 0.342$, $p < 0.001$) were all significantly and positively associated with mental well-being.

Mediation analysis. As suggested by Hayes (2009), an indirect effect can be significant when zero is not found between the lower and upper boundaries in the 95% confidence interval (CI). As seen in Table 4, the effect of empathy on mental well-being was significantly mediated by friendship quality ($\beta = 0.030$, $p < 0.001$, 95% CI [0.021, 0.039]), and friendship quality was also a significant mediator of the relationship between interpersonal trust and mental well-being ($\beta = 0.054$, $p < 0.001$, 95% CI [0.041, 0.066]). However, the path effect of self-control on mental well-being via friendship quality was not significant ($\beta = -0.002$, $p > 0.05$, 95% CI [-0.008, 0.004]). In addition, the bootstrap analysis indicated that the indirect effects of empathy and interpersonal trust on mental well-being via friendship quality accounted for 26.3% and 13.7% of the corresponding total effects, respectively.

Multiple-group analysis. Measurement invariance was first assessed for China versus Canada in order to verify the potential moderating effects of country. Bollen (1989) noted that measurement invariance is a matter of degree in that researchers decide which parameters should be tested, and to what extent and in what order these tests should be performed for group comparison. Based on the means of partial measurement invariance in the current study, configural invariance and metric invariance were supported, indicating that the two groups (China and Canada) shared the same factor pattern, that items were identical per construct, and that the patterns of factor loadings were equal for China and Canada. Therefore,

Table 1 Descriptive statistics of all study variables.

Variable	M (SD)	M (SD)	M (SD)
Entire sample (N = 5651)	Entire sample (N = 5651)	China (N = 3595)	Canada (N = 2056)
1. SEL	3.603 (0.423)	3.654 (0.432)	3.514 (0.449)
2. EMP	3.803 (0.480)	3.838 (0.423)	3.741 (0.572)
3. TRU	3.475 (0.650)	3.626 (0.669)	3.214 (0.640)
4. FRQ	3.068 (0.599)	3.008 (0.587)	3.174 (0.632)
5. MWB	2.987 (0.796)	2.984 (0.789)	2.993 (0.814)
6. Gender	0.509 (0.500)	0.512 (0.500)	0.505 (0.500)
7. SES	0.544 (0.936)	0.262 (0.819)	1.038 (0.924)

Gender was coded as 0 = female, 1 = male.
M mean, SD standard deviation, SEL self-control, EMP empathy, TRU interpersonal trust, FRQ friendship quality, MWB mental well-being, SES social economic status.

Table 2 Bivariate correlations among all study variables.

Variable	1	2	3	4	5	6	7
Entire sample (N = 5651)							
1. SEL	–						
2. EMP	0.512***	–					
3. TRU	0.316***	0.456***	–				
4. FRQ	0.213***	0.373***	0.422***	–			
5. MWB	0.312***	0.359***	0.481***	0.358***	–		
6. Gender	0.049**	-0.035*	0.063***	-0.071***	0.128***	–	
7. SES	0.071***	0.076***	-0.077***	0.184***	0.099***	-0.016	–

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3 Results of confirmatory factor analysis (entire sample).

Construct	Item coding	Factor loading
Item wording		
Self-control		
Can control my actions	STA_SEL02	0.513***
Think carefully before doing something	STA_SEL03	0.762***
Avoid mistakes by working carefully	STA_SEL04	0.596***
Stop to think before acting	STA_SEL07	0.744***
Often rush into action without thinking	STA_SEL08	0.539***
Empathy		
Can sense how others feel	STA_EMP03	0.634***
Know how to comfort others	STA_EMP04	0.568***
Understand what others want	STA_EMP06	0.689***
Warm toward others	STA_EMP07	0.546***
Interpersonal trust		
Believe that my friends can keep my secrets	STA_TRU02	0.610***
Distrust people	STA_TRU05	0.701***
Believe that other people will help me	STA_TRU06	0.636***
Believe that most people are honest	STA_TRU07	0.756***
Trust others	STA_TRU08	0.860***
Friendship quality		
My friends understand me	STQM03101	0.798***
My friends accept me as I am	STQM03102	0.845***
My friends are easy to talk to	STQM03103	0.829***
My friends respect my feelings	STQM03104	0.833***
Mental well-being		
Felt cheerful and in good spirits	STQM02001	0.835***
Felt calm and relaxed	STQM02002	0.739***
Felt active and vigorous	STQM02003	0.788***
Woken up feeling fresh rested	STQM02004	0.757***
Daily life has been filled with things that interest me	STQM02005	0.733***

*** $p < 0.001$.

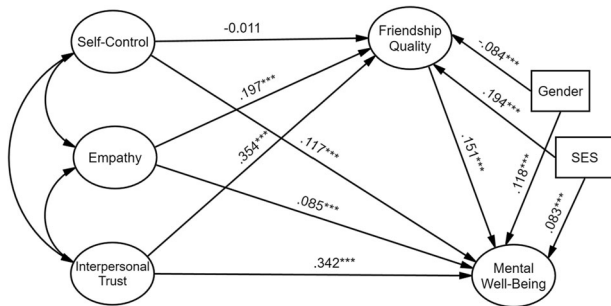


Fig. 2 Structural equation modeling (entire sample: $N = 5651$; gender was coded as 0 = female, 1 = male; *** $p < 0.001$).

subsequent multiple-group analyses were shown to be appropriate (Ghasemy and Elwood 2023; Schmitt and Kuljanin 2008; Yang et al. 2021).

Table 5 displays the results of the multi-group analysis. The effects of empathy ($\beta_{Difference} = 0.145, p < 0.01$) and interpersonal trust ($\beta_{Difference} = -0.161, p < 0.001$) on friendship quality were significantly different across China and Canada. Empathy was positively associated with adolescent mental well-being for China ($\beta_{China} = 0.116, p < 0.01$) but not for Canada ($\beta_{Canada} = 0.051, p > 0.05$), although no significant differences were found between the two countries. Meanwhile, some differences were revealed for the paths of gender to friendship quality ($\beta_{Difference} = 0.059, p < 0.05$) and

Table 4 The standardized direct and indirect effects among variables (entire sample).

Path/hypothesis	β	SE	95% CI	
			Lower	Upper
Effects of covariates				
Gender → FRQ	-0.084***	0.012	-0.109	-0.060
SES → FRQ	0.194***	0.013	0.169	0.220
Gender → MWB	0.118***	0.013	0.094	0.143
SES → MWB	0.083***	0.013	0.057	0.108
Direct effects				
SEL → FRQ (H_{1a})	-0.011	0.020	-0.049	0.027
EMP → FRQ (H_{1b})	0.197***	0.023	0.152	0.242
TRU → FRQ (H_{1c})	0.354***	0.018	0.318	0.390
FRQ → MWB (H_2)	0.151***	0.017	0.118	0.184
SEL → MWB (H_{3a})	0.117***	0.019	0.080	0.154
EMP → MWB (H_{3b})	0.085***	0.023	0.039	0.130
TRU → MWB (H_{3c})	0.342***	0.017	0.307	0.376
Indirect effects				
SEL → FRQ → MWB (H_{4a})	-0.002	0.003	-0.008	0.004
EMP → FRQ → MWB (H_{4b})	0.030***	0.005	0.021	0.039
TRU → FRQ → MWB (H_{4c})	0.054***	0.006	0.041	0.066

Gender was coded as 0 = female, 1 = male.

CI confidence interval.

*** $p < 0.001$.

Table 5 Results of the sample-specific and multiple-group analysis.

Path/hypothesis	β_{China}	β_{Canada}	$\beta_{Difference}$
Effects of covariates			
Gender → FRQ	-0.069***	-0.128***	0.059*
SES → FRQ	0.128***	0.046*	0.082**
Gender → MWB	0.079***	0.179***	-0.100***
SES → MWB	0.067***	0.016	0.051*
Direct effects			
SEL → FRQ (H_{5a})	0.008	-0.047	0.055
EMP → FRQ (H_{5b})	0.277***	0.132***	0.145**
TRU → FRQ (H_{5c})	0.330***	0.491***	-0.161***
FRQ → MWB (H_{5d})	0.113***	0.127***	-0.014
SEL → MWB (H_{5e})	0.118***	0.136***	-0.018
EMP → MWB (H_{5f})	0.116**	0.051	0.065
TRU → MWB (H_{5g})	0.346***	0.390***	-0.044
Indirect effects			
SEL → FRQ → MWB	0.001	-0.006	0.007
EMP → FRQ → MWB	0.031***	0.017**	0.014
TRU → FRQ → MWB	0.037***	0.062***	-0.025

Gender was coded as 0 = female, 1 = male.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

mental well-being ($\beta_{Difference} = -0.100, p < 0.001$), as well as SES to friendship quality ($\beta_{Difference} = 0.082, p < 0.01$) and mental well-being ($\beta_{Difference} = 0.051, p < 0.05$). Specifically, there was a significantly greater difference regarding friendship quality and mental well-being for boys versus girls in Canada than there was in China; SES showed a significantly stronger effect on friendship quality in China than in Canada, and SES was significantly associated with Chinese but not Canadian mental well-being.

Discussion

The present study investigated associations between self-control, empathy, interpersonal trust, friendship quality, and

mental well-being among adolescents in both China and Canada. We first constructed four hypotheses based on the extant literature, where H_2 and H_3 were fully supported, whereas H_1 and H_4 were only partially supported. The prediction for H_5 was formed to verify the potential moderating effect of the country. The empirical analysis indicated that H_{5b} , H_{5c} , and H_{5f} remain relevant, whereas the remaining H_5 items are rejected. Within the aggregate sample, it was found that empathy and interpersonal trust are positively related to mental well-being both directly and indirectly, with friendship quality as a mediator; these findings support those of previous studies (e.g., Clarke et al. 2021; Hecht et al. 2022; Helliwell and Wang 2011; Jakovljevic 2018; Kim et al. 2012; Martinez et al. 2019; Zhou et al. 2020). Self-control had only a direct effect on mental well-being due to the non-significant association between self-control and friendship quality, reflecting certain findings (e.g., Boals et al. 2011; Converse et al. 2018; Gokalp 2023; Kim et al. 2022) but not others (Boman et al. 2012; Boman et al. 2019). Furthermore, multiple-group analysis revealed a series of discrepancies between Chinese and Canadian participants regarding these associations.

The greatest difference between China and Canada was captured in the relationship between empathy and mental well-being. While empathy had no significant effect on the mental well-being of Canadian adolescents, it was significantly and positively associated with Chinese adolescents' mental well-being. Research has shown that empathy exerts different influences on personal affections and social interactions across collectivist and individualist cultural settings (Duan et al. 2008; Heinke and Louis 2009). Chinese culture is rooted in collectivism, which underscores group consciousness, social identity, emotional dependence, perspective taking, and understanding and sharing, which in turn are closely associated with positive psychological experience and emotional interaction (Hofstede 2001; Mann and Cheng 2013). Furthermore, inheriting of the ancient Confucian ethic, Chinese adolescents are expected from an early age to show altruistic behaviors towards and emotional interdependence with the people with whom they interact (Gummerum and Keller 2008; Huang et al. 2018). Therefore, it is not surprising that empathy plays a fundamental role in Chinese adolescents' social relationships and well-being (Huang and Su 2014; Huang et al. 2018). Conversely, individualistic societies such as is found in Canada tend to espouse values such as personal consciousness, emotional independence, and life autonomy, and due to a focus on privacy and non-interference, empathic concern may not be regarded as contributing value to individuals' affective interactions and well-being (Duan et al. 2008; Hofstede 2001; Rubin et al. 2006).

The findings also showed a significant difference, stronger among Chinese adolescents than among Canadians, in the relationship between empathy and friendship quality. This result could be interpreted with regard to previous studies, suggesting that reciprocally emotional interaction and empathic concern have a more intense impact on friendship quality in collectivistic rather than individualistic cultures (Gummerum and Keller 2008; Huang and Su 2014). However, individualist people like Canadians generally emphasize private, affective, and hedonistic considerations when establishing friendships, whereas Chinese adolescents are predominantly motivated by empathic-altruistic concerns for any newcomers (Chen et al. 2004; Gummerum and Keller 2008). Furthermore, similar results to ours were obtained by Chen et al. (2004). In comparison with Chinese boys, Canadian boys usually score higher in self-worth but lower in understanding, care, and instrumental assistance when establishing friendships (Chen et al. 2004). Moreover, an inverse association between emotional empathy and peer acceptance has

been found in a Western Canadian sample of adolescents, indicating that being emotionally expressive in the form of empathy is probably considered to be undesirable or "uncool" for this group (Oberle et al. 2010). The findings, therefore, suggest that empathy is more likely to be apparent in adolescents' friendships in China than in Canada.

Consistent with our expectations, the relationship between interpersonal trust and friendship quality was significant, with a stronger association for Canadian than for Chinese adolescents. This finding may probably be attributed to different implications of friendship and distinct roles of trust for the Chinese versus the Canadians. As opposed to the view of "friendship as therapy" in Western societies like Canada, friendships in China have a particular emphasis on mutual responsibility and social stability as set out in Confucian philosophy (Gummerum and Keller 2008). Unlike in an individualistic society, children in China are encouraged to value the collective zeitgeist, for example, as regards social identity, and interpersonal trust may also derive from adherence to social norms (Guo et al. 2022; Seeley and Gardner 2003). Actually, people in a collectivist society often form friendships out of common group benefits, regarding friendship as a way of integrating into the societal system (Gummerum and Keller 2008), with a relatively weaker effect of interpersonal trust on their friendship quality. While traditional individualism in Canada does not support the forming of the heart-to-heart interpersonal exchanges that are found in the Chinese collectivist context: Trust is relatively shallow in individualist societies, linked as it is to personal preferences and disposition (Gummerum and Keller 2008; Guo et al. 2022; Rubin et al. 2006). Therefore, when Canadian adolescents choose friends, interdependent trust is probably more important than it is for Chinese. In fact, much research has shown that individualism is indicative of a more extensive trust radius, which exerts greater effects on social interactions, peer relationships, and even global well-being (Guo et al. 2022; Luo et al. 2023; van Hoorn 2015).

Unexpectedly, we found that self-control did not have a significant association with friendship quality, and the expected indirect effect of self-control on mental well-being via friendship quality was also non-significant for both Chinese and Canadian participants. Such a finding may be attributed to the unique developmental stage of adolescence: Regarding the link between self-control and friendship quality, our findings may reflect that biological factors outweigh cultural factors (Ronen et al. 2016; Steinberg and Morris 2001). From the cognitive psychology perspective, adolescence is distinguished by dramatic physical, psychological, and personal transformation, where cognition becomes confused, intricate, unquestioning, and even imprudent (Erikson 1950; Steinberg and Morris 2001). Unlike adults, adolescents may make friends more subjectively, according to their feelings and preferences, rather than others' beneficial traits such as control, conscientiousness, and conformity (Akers et al. 1998; Shulman et al. 1997; Steinberg and Morris 2001). Findings suggest that in adolescence, the tolerance of others' individuality increases, whereas control and conformity in friendship decreases, thereby showing a relatively weak effect of control on friendships (Shulman et al. 1997). Therefore, when discussing the association between self-control and adolescent friendship quality, researchers should account for such cognitive propensities.

With regard to the effect of covariates on friendship quality and mental well-being, the results showed that the greatest difference between China and Canada was found in terms of the association between SES and mental well-being. SES had a positive effect on Chinese adolescents' mental well-being but had no significant impact on Canadians' mental well-being. This finding supports the view that the effect of income on well-being varies across societies (Haller and Hadler 2006; Zagorski 2011). Haller

and Hadler (2006) suggested that income has merely a small effect on well-being in high-income countries. Using an international comparative perspective, Zagorski (2011) proposed that high-income societies usually demonstrate a weaker association between income and well-being than that found in low-income societies. In comparison with China, Canada is considered a wealthy society where people generally have large incomes. Therefore, SES may be more likely to exert a significant impact on the mental well-being of Chinese than on Canadian adolescents, reflecting the regulation of diminishing marginal utilities of income, as well.

Implications, limitations, and future directions

Self-control, empathy, and interpersonal trust, three crucial components in the construct of social and emotional skills (OECD 2019), were used in our model to examine their effects on adolescent friendship quality and mental well-being. Although social and emotional skills may be effective in improving positive outcomes in a particular country, they may not be as effective in another (Miyamoto et al. 2015). Cross-national discrepancies in the impact of social and emotional skills are likely to be derived from differences in cultural contexts; thus, the exploration regarding potential associations among these social-emotional variables, based on their cultural-specific meanings, is required. Overall, our findings suggest some social and practical implications for policy application in social-emotional-related education as well as for the improvement of well-being for Chinese and Canadian adolescents.

Firstly, given that social-emotional learning has been highly recommended by both Chinese and Canadian policymakers in recent years (Tze et al. 2022; Wang et al. 2017), they could potentially consider organizing cultural-specific social-emotional learning, rather than applying a global construct (e.g., the Big Five) to their educational practices. For instance, empathy not only has a significant effect on the mental well-being of Chinese adolescents but not on that of Canadian adolescents but also exerts a relatively stronger impact on adolescent friendship quality in China than in Canada. Thus, empathic training could be considered more valuable for Chinese adolescents. Strengthening interpersonal closeness by blurring and expanding group boundaries, and experiencing emotional regulation in social interactions have both been shown to enhance adolescent empathic competency (Levine et al. 2005; Zaki 2020). In addition, since interpersonal trust has a significantly stronger effect on friendship quality for Canadian than for Chinese adolescents, interpersonal trust in social-emotional-related education may have a stronger effect on Canadian adolescent friendship quality. In fact, it is harder to develop trust in China versus individualist Canada because of the collectivist culture's emphasis from tight-knit groups on in-group boundaries and social control (Jasielska et al. 2018). Therefore, cross-group interactions should be salient in order to extend the interpersonal trust radius for Chinese adolescents.

Secondly, considering the significant impact that we found of SES on Chinese adolescents' mental well-being, policymakers might be encouraged to enact regulations that favor the mental well-being of disadvantaged students from low-income homes or rural areas in China. Previous research suggests that the level of individuals' economic well-being depends on social comparison, that is, as perceived relative income rather than absolute income (Easterlin 2001). Therefore, reasonable assistance policies should be employed to provide sufficient financial subsidies for students with low SES in China, a practice which would also have the effect of narrowing the family income gap to some extent. Although the Chinese financial support system in education has been gradually

designed since the early 21st century to mitigate educational inequalities, it leaves room for improvement (Li and Xue 2022). Financial assistance in Chinese elementary education schools generally comprises a unified management system, without considering the specific requirements of individuals in need of funding. Therefore, targeted poverty alleviation should be effectively implemented in the Chinese educational context.

Our study performed a range of analyses of measurement invariance that explored certain associations among self-control, empathy, interpersonal trust, friendship quality, and mental well-being by country, and we have discussed the structural relationships of these variables for Chinese and Canadian adolescents from a cross-cultural perspective of collectivism and individualism. Our study contributes to the literature in certain ways, as follows: The findings address gaps in the existing literature and provide scientific evidence for enhancing adolescent mental well-being across different cultural contexts. In addition, statistical tests employed in the study are of relatively high quality, and we used a large-scale sample size with a well-balanced gender representation.

Our study also has several limitations that need to be addressed in future research. Firstly, given that the present findings were based on cross-sectional data gathered in SSES 2019, the potential causal inferences cannot be explored. Therefore, robust longitudinal research designs should be employed in future research to examine causality. Secondly, the variables of self-control, empathy, interpersonal trust, friendship quality, and mental well-being were all reported by students in the current study. Future research should gather data from the perspectives of teachers and peers to limit or remove social desirability effects. Thirdly, we selected only 15-year-old adolescents as the sample so could not test potential cross-group differences in age. Future studies could investigate the structural relationships of these variables using an analysis of invariance according to different age groups. Fourthly, our cross-national comparison was based on only Chinese and Canadian samples, so future comparative studies could contain more Eastern and Western countries to further examine the relationships among these variables. Such a test may promote a mutual and in-depth understanding of the structural relationships among self-control, empathy, interpersonal trust, friendship quality, and mental well-being across different cultural contexts.

Conclusions

The present study explored the structural relationships among self-control, empathy, interpersonal trust, friendship quality, and mental well-being among Chinese and Canadian adolescents, and the results were discussed from the cross-cultural perspective of collectivism versus individualism. Previous studies tended to examine similar associations by comparing regression coefficients for each cultural group separately. Using a multi-group analytic approach within SEM, we conducted a simultaneous test of the structural relationships for the five variables for China and Canada which represent Eastern and Western cultures, respectively. The results indicate that, within the aggregate sample, self-control has only a direct impact on mental well-being, whereas empathy and interpersonal trust relate to mental well-being both directly and indirectly, with friendship quality as a mediator. In addition, the multiple-group analysis revealed that empathy exerts a positive effect on Chinese adolescents' mental well-being but not Canadians'. Although empathy had a significantly stronger effect on friendship quality for Chinese than for Canadian adolescents, interpersonal trust exerted a significantly stronger effect on friendship quality for Canadian than for Chinese adolescents. Critically, our findings suggest that the structural relationships of self-control, empathy, interpersonal trust,

friendship quality, and mental well-being may differ according to individuals' subject preferences, specific values, and social beliefs. Therefore, further research that examines potential associations among these variables and that is based on specific cultural settings is required.

Data availability

The datasets generated during and/or analyzed during the current study are available in the 2019 Survey on Social and Emotional Skills (SSES 2019) repository, <https://www.oecd.org/education/ceeri/social-emotional-skills-study/>.

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Author contributions

JN and CJ: conceptualization, methodology, software, supervision, validation, writing—original draft, and writing—reviewing and editing. LM: conceptualization, writing—original draft, and writing—reviewing and editing.

Competing interests

The authors declare no competing interests.

Ethics approval

The international organization OECD has completed the ethical norm for all participating countries/economies in the 2019 Survey on Social and Emotional Skills (SSES 2019).

Informed consent

Informed consent for all individual participants in the study has been officially completed by the international organization OECD.

Additional information

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