Gender differences in character strengths among Chinese pre-adolescents and adolescents: a multidimensional scaling profile analysis [version 2; peer review: 2 approved with reservations]

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Abstract
Background: The present study explores gender differences through a characterological lens, inspired by the positive-psychological VIA-Youth measure. Existing research on gender differences in character development has established a certain stereotype of girls outperforming boys in western culture.
Methods: Based on a sample of 695 students in elementary, middle, and high school students, we analyzed gender differences in character development in the Chinese cultural context using multidimensional scaling (MDS) profile analysis, providing a cultural account of gender differences via profile patterns.
Results: Our study identified specific items where pre-adolescent and adolescent boys outperformed girls (while acknowledging there are also specific items where girls outperformed boys) based on data sourced from a Chinese context. We found gender differences in the same character strengths due to situational factors, such as intensive and sustained educational interventions and established gender traditions/expectations, which can shape the exhibition of particular character strengths differently among girls and boys.
Conclusion: Findings can offer an antidote to a Western-dominated research perspective on character or moral education. It enriches the literature on moral education in a different cultural context and provides evidence of gender differences in character strengths.

Keywords
gender differences, characters strengths, pre-adolescents and adolescents, multidimensional scaling (MDS) profile analysis, cultural context
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Introduction

Character strengths have been perceived as central to character education in the Western moral and character education literature (Huo et al., 2022). Character strengths indicate the positive parts of the personality that impact how one thinks, feels, and behaves (VIA Institute on Character, 2020). Character strengths are also considered morally valued personal characteristics with admirable social qualities (McGrath & Walker, 2016). In character literature, the terms character strengths, and character traits are often used interchangeably to explore the science of positive psychology (e.g., VIA Institute on Character, 2020).

Historically, the so-called received wisdom considered women inferior to men in terms of character strengths. For example, in Freud’s words, women have been seen to possess a less developed “sense of justice” than men, be “less ready to submit to the great necessities of life,” and be “more often influenced in their judgments by feelings of affection or hostility”: features which Freud described to a unique female “modification in the formation of their super-ego” (Freud, 1927). Interestingly, however, research on gender and character over the past two decades has painted a uniform picture of girls outperforming boys characterologically. For example, a recently launched report on the meta-virtue of phronesis or practical wisdom (Kristjánsson et al., 2020), using a neo-Aristotelian Phronesis Model (APM) as a research tool, found that girls outperformed boys on all the four proposed components of phronesis: moral identity, moral sensitivity, moral reasoning, and moral emotions. Similarly, another earlier study from the Jubilee Centre (Arthur et al., 2015), utilizing moral dilemma tests, found that girls outperformed boys in all the different ways results were analyzed, including in identifying best and worst options in the dilemmas and opting for better reasoning and action strategies in circumstances that tested the virtues of honesty, courage, and self-discipline.

Nevertheless, two issues regarding gender differences in character strengths warrant further examination. First, methodologically, gender differences in character have often been reported concerning latent variables or factors (e.g., moral sensitivity) rather than discrete character strengths (e.g., compassion, honesty, loyalty). This may be one reason behind the now longstanding assumption – overturning the historically received wisdom mentioned by Freud – that girls uniformly outperform boys characterologically. In other words, when the character items are aggregated into one or more factors, they may well mask gender differences by averaging out the differences in each virtue item. We argue that besides examining gender differences at the latent factor level, it is also necessary to investigate how boys and girls may differ concerning profiles of character strengths.

Second, culturally, the science of character strengths from a positive psychology lens and Western educational philosophies (e.g., neo-Aristotelian) is perceived as central in their character education inquiry (McGrath & Walker, 2016). However, character strengths do not have equal importance in Chinese moral and character education (often being understood in psychological terms instead of psychological and moral terms); that is the moral value of character strengths has not been embraced. Yet, the notion of de meaning virtues (in Chinese德) has been accorded great importance in China, and the cultivation of virtues has been set as the fundamental mission of Chinese education (MOE, 2017). In fact, “character” and “virtues” are not two separate systems; they are considered as “one family,” with virtues as the first order traits and character strengths as the second-order traits (Peterson & Seligman, 2004). Such a framework enables cross-cultural communication within the science of character and virtues. It acts as the bridge for communication between Chinese moral education ideas and Western character education, exploring whether character strengths are universal or specific to context or situation factors, including gender differences.

The goal of the current study was to identify the profile patterns of the 30 earlier-identified character traits as presented via 35 items in the Code (see Underlying data (Xie & Huo, 2022)) for boys and girls, respectively, and to examine gender differences concerning the salient character strengths of the identified

1 Character education can be understood as any form of holistic moral education focusing on the systematic development of virtues as stable traits of character, with the aim of promoting human flourishing and founded on some general virtue theory (Watts & Kristjánsson, 2023). Some classical views of character (including Aristotles’s) only consider moral, civic and intellectual virtues. Some contemporary accounts of character in psychology (such as the work of Paul Tough or Angela Duckworth) focus overly on psychological performance virtues (which Aristotle would simply have called “techné”). We consider the definition from Watts and Kristjánsson more holistic as it considers all four types of virtues as making up character.
profile patterns. The 30 character strengths are extracted from the Chinese policy document on moral education called “The Code for Primary and Secondary Schools” (hereafter referred to as the Code) issued by the Chinese Ministry of Education in 2015. We were interested in whether profile analysis could yield new information about gender differences in character strengths among Chinese pre-adolescents and adolescents based on locally sourced data in the participants’ native language.

Specifically, we address the following research question: what are the most relevant gender differences in character strengths profiles using multidimensional scaling (MDS) profile analysis based on Chinese sourced data? Are there any culturally specific factors unique to Chinese culture in explaining these differences? A better understanding of gender differences in character strengths may help to explain why girls uniformly outperform boys characterologically. The study contributes to the field of positive psychology in two ways. First, it utilizes MDS profile analysis of character strengths to provide fine details that allow researchers to focus on gender differences in profile patterns. Second, it promotes communication between Chinese moral education and Western character education through the concept of character strengths (and virtues), allowing us to explore if character strengths are universal or specific to context or situation factors.

Literature review

The trajectory of “gender-difference” studies in the Western moral-education and character-development literature has now entered a new phase, coinciding with the transformation of a previously heterogeneous body of research literature into a more robust “science of virtue” (e.g., Brown et al., 2020; Fowers et al., 2021; McGrath & Brown, 2020). This new strand of work shifts the focus in gender studies from the old “Gilligan–Kohlberg debate” (Walker, 2006), expanding the research radar on gender and morality from standard issues, such as moral motivation (Malti & Buchmann, 2010; Nunner-Winkler, 2007), moral attitudes (Baker, 2020), moral sensitivity (Sparks, 2015), moral reasoning (Walker & Moulin-Stožek, 2019) and moral judgment (Pan & Sparks, 2012), towards a particular perspective that focuses on examining gender differences in character strengths and virtues. Those character qualities are then understood as multi-componential psycho-moral bundles that combine various morally relevant capacities (emotional, intellectual, behavioral) into overall dispositional tendencies to react and act in specific ways in particular spheres of human existence.

Character education and youth character strengths and virtues

Introducing the VIA Classification of Strengths and Virtues (Peterson & Seligman, 2004) marked a watershed in character research. It organically linked the concepts of character and virtues and proposed a hierarchy, with strengths presenting more contextualized incarnations of overarching virtues. Therefore, the VIA model offers a two-level structure: six virtues: Wisdom/Knowledge, Courage, Humanity, Justice, Temperance, and Transcendence, with 24 underlying character strengths. Although the VIA structure is considered cross-culturally valid (McGrath & Walker, 2016), it is limited to adult populations. The introduction of VIA-Youth (Park & Peterson, 2006) extended the benefits of the structural VIA model by giving special consideration to youth ages 10 to 17. This made the model more relevant for character education and the general development of youth (McGrath & Walker, 2016). It is worth noting that the use of VIA-Youth is not limited to the West; it has also been extended to other cultures, such as that of mainland China (e.g., Pan & Sparks, 2012; Wang, 2016; Ye et al., 2013).

Gender differences and adolescent moral and character strengths in the Western literature

Empirical studies in the West have shown females outperforming males in various tests of moral-characterological development. For example, Sparks (2015) found that female business students showed greater moral sensitivity than males in moral dilemma tests; adolescent girls are more inclined towards moral motivation (Malti & Buchmann, 2010; Nunner-Winkler, 2007), perspective-taking, and empathy than boys (Van der Graaff et al., 2014). In addition, in cross-cultural studies, girls have done better across cultures in reasoning about and adjudicating moral dilemmas (Arthur et al., 2015; Thoma et al., 2019; Walker & Moulin-Stožek, 2019; Walker et al., 2017). Notice that most of the studies mentioned here used performance tests, particularly gauging responses to moral dilemmas. In contrast, the VIA-Youth is a self-report measure that has been widely applied in numerous studies from a positive psychology lens (McGrath, 2015).

For example, one recent large-scale study by Brown et al. (2020) found that girls scored higher on average on most strengths than boys through a series of independent-sample t-tests comparing boys’ and girls’ character strengths. Girls scored significantly higher than boys on 18 character strengths: namely, all the 24 strengths except for Creativity, Prudence, and Self-regulation, where the mean for boys was higher (Brown et al., 2020). Another study by the Jubilee Centre (Arthur et al., 2015) reported that the overall variation between boys’ and girls’ character strengths also favors girls, although the results were only marginally significant for individual strengths, with the girls reporting higher for 15 strengths.

Gender differences and character strengths among Chinese adolescents

Positive psychology has garnered increasing research interest in China over the past two decades. Several studies have investigated Chinese adolescents’ psychological qualities and development. However, the findings have been under-reported in English, restricting cross-cultural communication and understanding. Some examples are illuminated below.

3 Existing studies in Chinese local context are mainly published in Chinese language, with little chance that these studies can be presented to wider international readership.
Studies into character strengths among Chinese adolescents are not unified using one measure, but different measures have been applied. For instance, the standard VIA-Youth was adopted to examine psychological qualities among Chinese adolescents aged 10–17 in Jiangsu (Pan & Sparks, 2012) and Guangxi province (Ye et al., 2013). Researchers’ self-developed character strengths measured with five virtue groups and 24 character strengths were applied among 11 to 15 years old students in Yunan province (Zhang et al., 2001). Measures based on Chinese policy documents, such as the Code, were used in Beijing (Huo et al., 2022) and twelve coastal towns (Luo, 2000).

Although easy to assess for direct international comparisons, the first type lacks consideration of the actual local context, arguably failing to grasp some character strengths that are considered important locally and highlighted in moral education, such as Patriotism in China (Huo et al., 2022). The second type is suitable for that particular research area but lacks national and international recognition and is challenging to communicate to a global audience. The third type is the measure we utilized in the present study. We selected the Chinese policy-based measure suitable for the Chinese context and has been subjected to some international comparisons, theoretical and empirical, in previous studies (Huo & Xie, 2021), including a juxtaposition with VIA-Youth (Huo et al., 2022).

Harmonizing with the Western literature’s findings regarding gender differences and character development, where girls mostly outperform boys in almost all the studies, the local Chinese studies have tended to paint a similar picture. For example, in one study, girls outscored boys significantly (p<0.01) in strengths including teamwork and friendliness, diligence and frugality, civilized life, self-discipline and law-abidingness, studying hard, filial piety to parents, and traditional virtues (Luo, 2000). Another study (Zhang et al., 2001) found that boys scored higher than girls on only five character strengths, while girls scored higher than boys on 13 character strengths.

Studies using the standard VIA-Youth measure have elicited similar findings. For instance, in one of the studies utilizing VIA-Youth (Pan & Sparks, 2012), the results suggested that on all the six overarching virtues, girls did significantly better than boys (P < 0.001). For the individual character strengths of creativity, perspective, and perseverance, no gender differences were registered. Boys only scored higher than girls on prudence; for all the rest, the girls excelled. In another study (Ye et al., 2013), the results showed girls scoring higher than boys on all the six virtues (P<0.001). A study into positive psychological qualities after the Sichuan earthquake showed that boys scored higher than girls on wisdom/knowledge, while girls scored higher than boys on humanity (Zhang et al., 2009). Finally, recent large-scale research on the psychological qualities of adolescents in China (Ren et al., 2019) reported that girls’ psychological qualities were healthier than boys’ overall, based on the scoring of all the six virtues.

To sum up, these local studies are under-reported in the West. Although boys occasionally scored higher on a few character strengths, girls outperformed boys generally in national studies and studies at multiple research locations in China. This is especially true for the higher-order virtues, which tend to occupy a meta-level in research replicating and be influenced by the VIA-model4. These gender differences have reinforced the image of good school girls as if girls are “naturally” good or better than boys, and it offers excuses when boys indeed do not perform well enough in either academic performance or general behavior. Hence, it has made up an un-balanced or un-equal educational view towards male and female students.

While these findings from China echo the Western literature, the reason girls outperform boys seems to suggest some anecdotal reasons, such as that girls are more concerned about social desirability than boys and hence rate themselves higher in self-report surveys, or that girls are, for evolutionary reasons, genetically adapted to be more responsive to moral concerns. However, it must be borne in mind that not all the character strengths posited by the VIA model are specifically moral; some are intellectual (such as curiosity) or have to do with a strong motivation for achievement (e.g., zest), which can be either moral or immoral depending on the context or situation factors.

For the current study, we hypothesize that gender differences may exist on the identified profiles of character strengths, and culturally specific or situational factors may help to explain these gender differences. Little consideration has been given to linking potential cultures and situations to character strengths in the current literature.

Methods

Ethics

Before data collection, written informed consent was obtained from school administrators, parents, and participants. The questionnaires were completed in class voluntarily, and students who did not want to participate could read a book instead. Data were not collected from students who missed school on the day of data collection. It took about 15 minutes for students to complete the survey, including basic demographic information and 35 Code items. Before their distribution, a brief introduction was given, stressing that there were no right or wrong answers, so respondents could answer according to what they truly believed about themselves. The study was approved by Tsinghua University’s research ethics committee.

4 However, this distinction between virtues and character strengths normally does not exist in philosophical virtue theories (Kristjánsson, 2015). But It does exist in the work represented by Peterson & Seligman (2004), in which it is stated that virtues are the core characteristics valued by moral philosophers and religious thinkers: wisdom, courage, humanity, justice, temperance, and transcendence (p.31), whilst character strengths are the psychological ingredients – processes or mechanisms – through which the virtues are manifested. Said another way, they are distinguishable routes to displaying one or another of the virtues. For example, the virtue of wisdom can be achieved through such strengths as creativity, curiosity, love of learning, open-mindedness, and what they call perspective: having a “big picture” in life (p.32).
Participants
The participants of the study were from six primary and secondary schools in Beijing5 and comprised three student cohorts: grade three (age 9) and grade six (age 12) in Primary School, and grade three (age 15) in Secondary School. Among 695 participants, 46% were males, and 54% were females. Most participants were single children in the family6, resulting from the “one-child” policy7 (CCCPC, 1980).

Measure
We utilized the Code for Primary and Secondary Schools as a blueprint to design the main section of a self-assessment survey, which contained the 35 items. As mentioned previously, these 35 code items represent 30 character strengths (see Table 1). Thus, the present study follows the language of the extracted character strengths instead of the original 35 items. Participants completed a self-assessment survey using a five-point rating scale, with 1= describes me and 5 = does not describe me, to report their competence concerning these 35 items in the Code. We re-coded the response scale so that the high scores indicate a higher level of endorsement. The questionnaire showed a high internal consistency (α = .95).

Procedure
We administered the survey among the three cohorts in six schools in Beijing and obtained 695 valid self-assessment questionnaires. All the schools were members of the Beijing Institute of Schools for Moral Education. The selection tried to mimic the Chinese social composition, representing a balanced mix of urban and sub-urban areas.

Analysis design
One striking feature of most previous studies is their uniform method of analyzing data. All the studies we reviewed utilized t-tests (e.g., Pan & Sparks, 2012; Wang, 2016; Ye et al., 2013). This also applies to most of the studies reported upon in the Western literature. In order to get a better picture of gender differences regarding character strengths, in this study, we used profile analysis via multidimensional scaling (MDS) (Davison et al., 1996) to compare profiles of character between males and females on salient character strengths. Ding (2006) have discussed the MDS profile analysis, which has been used in numerous studies (e.g., Mckay et al., 2018; Tziner et al., 2020). Because of the page limit, we could not describe the MDS profile analysis in detail, and readers who are interested in the method can consult Davison et al. (1996) or Ding (2006). Here, we only highlight some key aspects of MDS profile analysis.

Table 1. The code items and extracted character strengths (Huo et al., 2022).

<table>
<thead>
<tr>
<th>The code's items</th>
<th>Extracted character strengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1. Understand the Party history and the national conditions</td>
<td>A1. Awareness (national awareness)</td>
</tr>
<tr>
<td>A2. Cherish the honor of the country</td>
<td>A2. Loyalty</td>
</tr>
<tr>
<td>A3. Love the nation, love the people, love the Communist Party of China</td>
<td>A3. Patriotism</td>
</tr>
<tr>
<td>A4. Listen attentively in class</td>
<td>A4. Love of learning</td>
</tr>
<tr>
<td>A5. Express opinions actively</td>
<td>A5. Bravery</td>
</tr>
<tr>
<td>A6. Willing to explore science</td>
<td>A6. Curiosity</td>
</tr>
<tr>
<td>A7. Form the habit of reading</td>
<td>A7. (Love of learning)</td>
</tr>
<tr>
<td>A8. Do your own work by yourself</td>
<td>A8. Industriousness</td>
</tr>
<tr>
<td>A9. Take the initiative to share housework</td>
<td>A9. Diligence</td>
</tr>
<tr>
<td>A10. Participate in labour practice</td>
<td>A10. Dedication</td>
</tr>
<tr>
<td>A12. Abide by the national law and school discipline</td>
<td>A12. Self-regulation</td>
</tr>
<tr>
<td>A13. Line up consciously and politely</td>
<td>A13. Fairness</td>
</tr>
<tr>
<td>A15. Protect public property</td>
<td>A15. (Citizenship)</td>
</tr>
</tbody>
</table>
In the MDS profile model, dimensions represent prototypical profiles (i.e., prototypicality of character strengths), and the fundamental variables are scale values for these character variables. Thus, prototypical profiles indicate a particular arrangement of character among individuals. The number of profiles in the data can be determined by model fit index, Stress value, and interpretability.

In MDS profile analysis, we can use salient character items as marker items to capture gender differences among characters in the profile since these salient character items are used to define the profiles. Specifically, to improve the interpretability of profiles, items of character are converted to standard scores so that the scale value of 1 for a particular virtue item indicates that it is one standard deviation higher than the mean. Salient character items are one standard deviation above the mean scale value. These salient character items define profile patterns for males and females. The differences in salient character items of a profile between males and females indicate gender differences with respect to the profiles. In other words, the gender difference in profiles of character strengths was defined in terms of salient character strengths of the profile. If a character strength was salient in the profile for boys but not for girls, this character strength was considered to show gender difference.

To examine gender differences in profiles of character strengths, we conducted MDS profile analysis for males and females separately. Then we compared the gender differences concerning the identified profiles. The profile similarity was examined by (1) Procrustes analysis (Gower, 1975) and (2) correlational analysis of each profile between females and males. The value of similarity index $P_0$ in Procrustes analysis and correlation between two profiles greater than or equal to .95 indicates two profiles are the same.

All the analyses in the current study were conducted using SAS (SAS, 2013), a commonly used statistical package.

**Results**

**Prototypical profiles**

We performed one-profile and two-profile analyses, and the results suggested that the fit index (stress value) was .19 for males and .20 for females in the one-profile solution and .12 for...
males and 0.14 for females in the two-profile solution. The first profile in the two-profile solution was the same as the profile in the one-profile solution for both males and females. However, the fit statistic for individuals was lower in the one-profile solution, suggesting that the one-profile solution may not fit the data well. Considering these results and interpretability, we selected the two-profile solution as our final model for examining gender differences in profiles of character strengths.

The scale values from a two-profile solution are shown in Table 2 by each profile and gender. These scale values were used to define profiles, which reflected the patterns of character under inquiry. As mentioned previously, scale values greater than one were considered salient profile markers. Thus, we focused on the character strengths whose scale values were greater than 1 in the profiles. We considered gender differences among character strengths when the salient character strengths between the males and females were different in the profile, and the difference between the scale values was greater than 0.5 standard deviations. The results from the Procrustes analysis indicated configuration similarity index $P_c$ to be 0.82, suggesting configuration between females and males had some differences. As assessed by correlation, the profile similarity index was .89 for the first profile, suggesting some gender differences among character strengths, and .44 for the second profile, suggesting quite a bit of gender differences among character strengths.

To visualize the gender differences among those character strengths, Figure 1 shows the first character profile for females and males. On the positive end of profile 1, boys had a higher scale value on character A7 (love of learning), a8 (industriousness), a9 (diligence), a18 (open-mindedness), and a20 (honesty & integrity) than girls, while girls had a higher scale value on character a6 (curiosity) and a24 (self-regulation) than boys. On the negative end of profile 1, boys had a higher scale value on characters a3 (patriotism) and a32 (modesty) than girls. Thus, boys and girls differed concerning these character strengths for pre-adolescents and adolescents who resembled this profile.

Figure 2 shows profile 2 of the character, which was a less pronounced configuration than profile 1. On the positive end of profile 2, girls had a higher level on a5 (bravery) and A6 (curiosity) than boys, while boys had a higher level on character a18 (open-mindedness) than girls. At the negative end of profile 2, girls had higher character a9 (diligence) and a30 (cherishing life). Thus, boys and girls differed on these five character strengths for pre-adolescents and adolescents who resembled this profile. Table 3 summarizes these differences in character strengths.

In order to compare the gender differences identified in the MDS profile analysis with those identified using standard t-tests at the individual character-strength level, we performed multiple t-tests of the 35 character items using multiple test procedures by adjusting the $p$-values from a family of hypothesis tests. The results indicated that only two character strengths (A14 Citizenship and A29 Prudence) showed gender difference, with boys having a higher mean value than girls.

| Table 2. Scale values of profile of character strengths for boys and girls. |
|----------------------|----------------------|----------------------|----------------------|----------------------|
|                      | Profile 1          |                      | Profile 2          |                      |
|                      | Female | Male | Female | Male |
| A1                   | 2.50   | 2.39 | 0.27   | 0.17 |
| A2                   | 1.37   | 0.96 | 0.54   | 0.27 |
| A3                   | -0.52  | -1.03| 0.21   | -0.16 |
| A4                   | 1.11   | 1.57 | 1.29   | 1.06 |
| A5                   | 1.70   | 2.14 | 1.67   | 0.52 |
| A6                   | 2.13   | 0.50 | 1.15   | 0.03 |
| A7                   | 0.54   | 1.44 | 0.60   | -0.75 |
| A8                   | 0.48   | 1.25 | 0.21   | -0.39 |
| A9                   | 1.36   | 2.17 | -1.31  | -0.78 |
| A10                  | 1.34   | 0.90 | -0.24  | -0.86 |
| A11                  | 1.90   | 2.02 | -1.26  | -1.55 |
| A12                  | 0.00   | -0.29| 0.40   | -0.02 |
| A13                  | -0.98  | -0.96| 0.23   | 0.15 |
| A14                  | -1.08  | -0.68| 0.08   | 0.00 |
| A15                  | -1.33  | -1.14| 0.18   | 0.05 |
| A16                  | -0.75  | -0.44| 0.13   | 0.12 |
| A17                  | -0.32  | -0.29| 0.03   | 0.38 |
| A18                  | 0.59   | 1.28 | -0.58  | 1.56 |
| A19                  | 0.91   | 0.35 | -0.49  | 0.37 |
| A20                  | 0.37   | 1.45 | -0.13  | 0.43 |
| A21                  | 0.15   | 0.57 | -0.30  | 0.75 |
| A22                  | -1.22  | -0.88| -0.10  | 0.23 |
| A23                  | -0.08  | -0.05| -0.16  | 0.39 |
| A24                  | 1.85   | 0.68 | -0.84  | -0.31 |
| A25                  | -0.86  | -1.07| -0.10  | 0.02 |
| A26                  | -1.97  | -1.95| -0.03  | -0.11 |
| A27                  | -1.53  | -1.59| 0.11   | 0.04 |
| A28                  | -1.68  | -1.77| 0.16   | 0.02 |
| A29                  | -1.84  | -1.84| -0.03  | -0.03 |
| A30                  | 0.84   | -0.64| -1.03  | -0.41 |
| A31                  | -2.14  | -2.05| 0.12   | -0.07 |
| A32                  | -0.69  | -1.38| -0.15  | -0.19 |
| A33                  | -1.48  | -1.55| -0.09  | -0.21 |
| A34                  | -0.20  | -0.18| -0.28  | -0.32 |
| A35                  | -0.47  | 0.12 | -0.27  | -0.41 |

Note. The content of A1 to A35 can be seen in Table 1.
Figure 1. Character strengths along profile 1 for boys and girls. Note. Items extracted character strengths with gender difference: A3 = patriotism, A6 = curiosity, A7 = love of learning, A8 = industriousness, A9 = diligence, A18 = open-mindedness, A20 = honesty & integrity, A24 = self-regulation, A32 = modesty.

Figure 2. Character strengths along profile 2 for boys and girls. Note. Items extracted character strengths with gender difference: A5 = bravery; A6 = curiosity; A9 = diligence; A18 = open-mindedness; A30 = cherishing life.
Discussion

Our findings differ from the traditional perception established in the literature, where girls generally outperform boys in various moral and character development aspects. Furthermore, our findings feed into the ongoing discourse on gender differences from a character lens. Specifically, boys’ scale values are higher than girls on seven character strengths in the two profiles, while girls’ scale values are higher than boys’ on only five character strengths. Why this is the case admits several possible different explanations. From a methodological perspective, MDS profile analysis is a mixture modeling technique (Wählstedt et al., 2009), which assumes that populations are heterogeneous and there are different unobserved groups of individuals in the data. MDS profile analysis identifies these unobserved groups of individuals, with each profile representing a group of individuals. The gender comparison was made based on these latent groups assumed to have different character trait patterns.

In contrast, t-test or ANOVA assumes that the population is homogeneous concerning certain traits and that one group of individuals is in the data. Thus, gender comparisons are made based on one group of individuals who are assumed to be similar concerning character traits. The differences in methodological paradigm may contribute to the different findings on how gender differences emerge. Among the above-identified character strengths with gender differences, three character strengths stand out: curiosity, diligence, and open-mindedness, as these three character strengths show gender differences not just in a single profile but across two profiles. We found that the character strength of curiosity had a greater scale value among girls than boys in both profiles, while open-mindedness was higher for boys than girls in both profiles. Diligence shows contradicting results, where boys’ scale value is greater than girls in profile 1 and reversed in Profile 2. The rest of the identified character strengths show gender differences in Profile 1 or 2. The following discussion will explain this in more detail.

Double profile gender differences in character strengths

Our findings are consistent with a previous Chinese study (Pan & Sparks, 2012) in that Chinese girls were stronger than boys on curiosity, although curiosity did not register a significant gender difference in a cross-cultural study (Brown et al., 2020). The character strengths of open-mindedness and curiosity are worthy of special attention since these are the two character strengths giving the same and consistent results in both profiles.

It may seem strange at first glance that boys consider themselves stronger in open-mindedness, but girls on curiosity, as both are intellectual capacities that have to do with an eagerness to learn new things. One possible explanation is that open-mindedness refers to being open to embracing new ideas and knowledge from the outside world. This strength of character has been well illustrated in Chinese history through the example of revolutionary pioneers (e.g., Duxiu Chen; Dazhao Li) who first introduced socialist core values to China, which they had picked up from external sources (e.g., Karl Marx). Those have been primarily male figures, and it raises additional cultural questions, which may provide implications for the various character strengths the study explores. For example, in Chinese tradition, males had privileged access to education in China, especially when compared to females. Culturally, males were favored in family heritage and concerning training and learning, and females were less favored and had limited access to education and learning. As the outdated Chinese proverb goes, “mediocrity is the virtue of women,” which no longer fits modern Chinese society. However, such cultural sequelae may still operate quietly in some areas in China.

Broadly speaking, education and learning have the potential to open the mind, which means that boys may pick up the strength of open-mindedness through emulation of local historical role models. Meanwhile, “curiosity” in Chinese carries connotations of an emotion-laden desire for knowledge born from inside of one’s heart. Recall that we are handling self-reported strengths, not objective ones identified via performance tests. Hence, results are likely to be heavily influenced by social norms and expectations.

Single-profile gender differences in character strengths

Our results on other gender differences in character strengths, which they only exhibit in a single profile, show similarities with previous studies. For example, we found boys’ character strengths stronger than girls’ on love of learning in profile 1 but
no gender differences in profile 2, whereas Pan & Sparks (2012) found that girls excelled significantly over boys on this strength, but no gender differences were recorded by Brown et al. (2020). In our findings, honesty (and integrity) show boys scoring higher than girls in profile 1 but no gender differences in profile 2. In both a Western and a Chinese study, girls scored significantly higher than boys on honesty (Brown et al., 2020; Pan & Sparks, 2012). Bravery in our findings shows girls scoring higher than boys in profile 2, consistent with previous studies (Brown et al., 2020; Pan & Sparks, 2012). Modesty in our study shows boys scoring higher than girls in profile 1 but no gender differences in profile 2. This differs from previous studies where girls scored higher than boys on modesty (Brown et al., 2020). On self-regulation, our study findings are consistent with Pan & Sparks’s (2012) that girls score higher than boys but clash with Brown et al. (2020). We have no reference points for comparisons for other character strengths, such as patriotism and industriousness, which are not included in VIA-Youth but were extracted from the Chinese context.

Situational factors
It is worth reporting that three character strengths show different gender responses under different situations (i.e., under different items). As reported above, 30 character strengths were extracted from 35 items. What this entailed was that different items were extracted as the same character strength on several occasions, with items A4 and A7 both named love of learning; items A14 and A15 both named citizenship; items A22 and A23 both named responsibility; items A12, A24, A26 and A27 all named self-regulation; item A30 and A31 both named cherishing life; item A33 and A35 both named environmental concern.

For the character strength, love of learning, in situations such as elicited in item 7 (“form the habit of reading”), there is a gender difference in that boys scored higher than girls, but under situations such as in item A4 (“listen attentively in class”) no gender differences emerged. This finding echoes the above finding that boys are more open-minded and more willing to embrace new ideas and pursue learning new knowledge, as illustrated by their love of reading. Unsurprisingly, however, no gender differences emerged on A4, “listen attentively in class,” as this is the situational factor at work that is external school and class norm (or teacher’s presence) that regulates all students’ behavior.

For the character strength of self-regulation, item 24 (“Do physical exercise”) showed gender differences in that girls reported higher values than boys, but not on items A12 (“abide by the national law and school discipline”), A26 (“No smoking, no drinking”) and A27 (“be civilized in using the internet in a green and healthy way”). Based on this finding, it seems that girls are more self-regulated in doing physical exercise than boys. We suspect there may be some cultural expectations at work here (not necessarily Chinese only) towards current and traditional Chinese beauty norms, with females expected to be thin. As a famous Chinese poem line from Guanju goes, “A slim and graceful lady is there, a gentleman is wooing.” Looking into items A12, A26, and A27, they all refer to external rules that regulate students’ behaviors. Similar to the above discussion on A4, “listen attentively in class,” it seems that when external norms or rules at work encourage the character strengths, those show less gender difference. However, when the character strengths are mostly internally motivated, such as taking the initiative to read or do physical exercise, they tend to show gender differences.

This discussion of situational factors and local variance has shown that external factors, especially Chinese traditional cultural influences, such as valuing males’ access to education, can shape the exhibition of specific character strengths differently among girls and boys (e.g., open-mindedness). As Aquino et al. (2009) hypothesized, situational factors can increase the accessibility of certain “moral schemas,” and such factors have varying “activation potential.” Situational factors can similarly increase or decrease the exhibition (or, in this case, the self-reported mastery) of character strengths. Our findings also seem to resonate with Spark’s (2014) study, where the researcher reported the effects of situational factors (moral content priming and greater moral intensity) on individual characteristics of moral identity. Although that study’s focus was on moral sensitivity through a social cognitive process, it is still interesting to observe a similar pattern in exploring character strengths; namely, character-strength aspirations or related priming, and the intensity of priming can enhance or weaken the strengths of character.

Future studies should further explore how situational factors mediate character strengths; also, if these results are applicable in other social contexts, and how this may impact the most serviceable character-education strategies in schools and classrooms to promote the development and flourishing of both boys and girls. More philosophically speaking, attention to the role of situational factors may offer a conciliatory middle-ground position between the extremes of moral universalism and relativism. For example, although VIA-led research on character strengths has indicated their overall universality (McGrath, 2015), cultural relativism may emerge at the level of situational factors that influence and mediate the strength of the relevant character qualities in the relevant circumstances. This is one of the reasons why we consider the method selected for this study, and the focus on individual strengths rather than overarching virtues, to be apt.

We consider both the hypotheses undergirding this study to have been confirmed, both about the uniqueness of our method and the difference (e.g., culturally specific factors or situational factors towards males and females) between results at the individual character strengths level.

Limitations
The findings of gender differences need to be considered in light of some study limitations. First, the criterion we used to define the salient character strengths was somewhat arbitrary, and we erred on the conservative side by using one standard deviation above the mean level to identify salient markers.
Second, as already noted, the present study focused on gender differences at the character-strengths level instead of classifications of (moral) character at a higher-order level, which is a topic worthy of exploration in future studies. Third, the present study’s data were mainly from Beijing; future studies should consider gathering data in broader Chinese and international contexts. Fourth, the character strengths examined in our study were extracted from the code items, and thus we were constrained by what the existing codes reflected. Despite these limitations, the current study has opened up new vistas for discussing gender differences in character strengths.

Data availability
Underlying data
Figshare: character-Data.xlsx
https://doi.org/10.6084/m9.figshare.19897186.v2 (Xie & Huo, 2022)
This project contains the following underlying data:
- character-Data.xlsx
Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

References

Reference Source
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Publisher Full Text
Publisher Full Text
PubMed Abstract | Publisher Full Text
Reference Source
Reference Source
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Tziner A, Fein EC, Kim SK, et al.: Combining associations between emotional intelligence, work motivation, and organizational justice with


The study contributes to the field of positive psychology through the MDS profile analysis of character strengths, as well as promoting communication between Chinese moral education and Western character education with the concept of character strengths (and virtues).

It is an interesting and relevant study in that it explores the universality of character strengths. It does so by drawing on studies already conducted in the Chinese context.

The introduction is well structured and justifies the need for the study by providing sufficient literature. As a suggestion, the study by Ruch, W., & Proyer, R. T. (2015). Mapping strengths into virtues: the relation of the 24 VIA-strengths to six ubiquitous virtues. Frontiers in Psychology, may be included.\footnote{1}

The method justifies the use of the t-test through previous research (e.g., Pan & Sparks, 2012; Wang, 2016; Ye et al., 2013) but finally a profile analysis through multidimensional scales (MDS) is decided (Davison et al., 1996), a decision that is also explained and justified. Example "Then we compared the gender differences concerning the identified profiles. The profile similarity was examined by (1) Procrustes analysis (Gower, 1975) and (2) correlational analysis of each profile between females and males. The value of similarity index P0 in Procrustes analysis and correlation between two profiles greater than or equal to .95 indicates two profiles are the same".
Minor suggestions

Although it is stated in footnote 4 that the "distinction between virtues and character strengths normally does not exist in philosophical virtue theories", there is a lack of critical literature on the position that character strengths are psychological-moral, and not specifically/merely moral. It could be objected to this approach that most character strengths are virtues that are part of the "higher order virtue"; meaning, they are not psychological but moral.

In footnote 1 there is a definition of Character Education (Wats & Kristjánsson, 2023) that would merit some comment. It is not clear why this definition is considered to be more holistic than others, because it is focused on virtue education, as the classical approach does. Although this may be collateral, this is a relevant issue and perhaps something could be said about it.

Avoid repetition to improve the wording of the first paragraph: "character strengths" heads the first 3 sentences of the article.

It is mentioned that informed consent was obtained from the participants (school administrators, parents and adolescents) as well as approval of the research ethics code from Tsinghua University. The study subjects were also allowed not to participate or not to continue with the study. However, it is suggested to elaborate more on the context of the study, i.e. to provide more information on the primary and secondary schools and how and why they were chosen.

Points that must be addressed

The authors of the study state that the findings differ from the perception established in Western and Chinese literature, where girls generally outperform boys in various moral and character development aspects, however, the results were contrasted with few authors such as Brown et al. (2019) and Pan & Sparks (2012) where it is explicitly stated that Pan & Sparks’ study was conducted in China and that Brown et al.’s study is a cross-cultural study.

Therefore, being one of the questions of the study "Are there any culturally specific factors unique to Chinese culture in explaining these differences?" one would expect in the discussion more research or, in case there is no previous research, to comment on other Western research that has also found cultural differences, although not carried out in the Chinese context, in order to analyse how they explain these differences.

The authors note that “The majority of the participants were single children in the family, resulting from the "one-child" policy” (p.5). Have the authors considered how this influences the development of character strengths? Most of the character strengths are relational in themselves or develop in relation to other people, so this should be considered, also taking into account the importance of the family in character education. Other questions also arise: To what extent does this condition influence the findings of the study? Is there any previous research involving only children in the study of gender differences in character strengths in China or other countries?

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.
References

Is the work clearly and accurately presented and does it engage with the current literature?
Yes

Is the study design appropriate and does the work have academic merit?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

Are all the source data and materials underlying the results available?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** CAMILLI: QUALITATIVE RESEARCH AND SYSTEMATIC REVIEW; ROMERO-IRIBAS: EDUCATIONAL ETHICS AND FRIENDSHIP STUDIES

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.

Author Response 10 Oct 2022

**Yan Huo,** Tsinghua University, Beijing, China

**Comment:** The study contributes to the field of positive psychology through the MDS profile analysis of character strengths, as well as promoting communication between Chinese moral education and Western character education with the concept of character strengths (and virtues). It is an interesting and relevant study in that it explores the universality of character strengths. It does so by drawing on studies already conducted in the Chinese context.

**Response:** Dear Professor Romero-Iribas & Trujillo, Thank you for your important comments. We are encouraged to receive your acknowledgment of the contributions of our manuscript. We are glad that our work has contributed to the communication between Chinese moral education and Western character education through the concept of character and virtues, as indeed moral and character education should be the prime concern of all education.
**Comment:** The introduction is well structured and justifies the need for the study by providing sufficient literature. As a suggestion, the study by Ruch, W., & Proyer, R. T. (2015). Mapping strengths into virtues: the relation of the 24 VIA-strengths to six ubiquitous virtues. Frontiers in Psychology may be included.

**Response:** We would like to thank the reviewers for suggesting the paper by Ruch, W., & Proyer, R. T. (2015); it is interesting research and also inspiring. We have added the reference on page 31, footnote 8. It would also be valuable to conduct similar research in the Chinese context to see if there are any differences from a Chinese perspective? That would be something that we would like to explore in our future study.

**Comment:** The method justifies the use of the t-test through previous research (e.g., Pan & Sparks, 2012; Wang, 2016; Ye et al., 2013) but finally a profile analysis through multidimensional scales (MDS) is decided (Davison et al., 1996), a decision that is also explained and justified. Example "Then we compared the gender differences concerning the identified profiles. The profile similarity was examined by (1) Procrustes analysis (Gower, 1975) and (2) correlational analysis of each profile between females and males. The value of similarity index P0 in Procrustes analysis and correlation between two profiles greater than or equal to .95 indicates two profiles are the same".

**Response:** Thank you for being complimentary about our research methods.

**Comment:** Although it is stated in footnote 4 that the "distinction between virtues and character strengths normally does not exist in philosophical virtue theories", there is a lack of critical literature on the position that character strengths are psychological-moral, and not specifically/merely moral. It could be objected to this approach that most character strengths are virtues that are part of the "higher order virtue": meaning, they are not psychological but moral.

**Response:** We would also like to thank the reviewers for pointing out the missing element in our literature review. We should have added lines that explain how character strengths are psycho-moral, rather than merely moral. We have added clarification in footnote 4, on page 10. The work by Peterson and Seligman (2004) helps clarify this, in which it is stated that virtues are the core characteristics valued by moral philosophers and religious thinkers: wisdom, courage, humanity, justice, temperance, and transcendence (p.31), whilst character strengths are the psychological ingredients - processes or mechanisms - through which the virtues are manifested. Said another way, they are distinguishable routes to displaying one or another of the virtues. For example, the virtue of wisdom can be achieved through such strengths as creativity, curiosity, love of learning, open-mindedness, and what they call perspective: having a “big picture” on life (p.32).

**Comment:** In footnote 1 there is a definition of Character Education (Wats & Kristjánsson, 2023) that would merit some comment. It is not clear why this definition is considered to be more holistic than others, because it is focused on virtue education, as the classical approach does. Although this may be collateral, this is a relevant issue and perhaps something could be said about it.

**Response:** Thank you for pointing it out. Some classical views of character (including Aristotle's) only consider moral, civic and intellectual virtues. Some contemporary accounts of character in psychology (such as the work of Paul Tough or Angela Duckworth) focus overly on psychological performance virtues (which Aristotle would simply have called “techné”). We consider the definition from Watts and Kristjánsson more holistic as it
considers all four types of virtues as making up the character. We have added this explanation in the text, on page 3.

**Comment:** Avoid repetition to improve the wording of the first paragraph: "character strengths" heads the first 3 sentences of the article.

**Response:** Thank you for your further comment. We should have said: Character strengths have been perceived as central to character education in the Western moral and character education literature (Huo et al., 2021). It indicates the positive parts of the personality that impact how one thinks, feels, and behaves (VIA Institute on Character, 2020). The strengths of character are also considered morally valued personal characteristics with an admirable social quality (McGrath & Walker, 2016). And we have made the change in the text, page 3.

**Comment:** It is mentioned that informed consent was obtained from the participants (school administrators, parents and adolescents) as well as approval of the research ethics code from Tsinghua University. The study subjects were also allowed not to participate or not to continue with the study. However, it is suggested to elaborate more on the context of the study, i.e. to provide more information on the primary and secondary schools and how and why they were chosen.

**Response:** Thank you for your comments on this important piece of information. We have now provided it here: We administered the survey in six schools located in Beijing and obtained 695 valid self-assessment questionnaires. The sample of schools was purposefully selected. All the schools which took part were members of the Beijing Institute of Schools for Moral Education. The selection tried to mimic the Chinese social composition, representing a balanced mix of urban and sub-urban areas. We have added this informant on page 10, footnote 5.

**Comment:** The authors of the study state that the findings differ from the perception established in Western and Chinese literature, where girls generally outperform boys in various moral and character development aspects, however, the results were contrasted with few authors such as Brown et al. (2019) and Pan & Sparks (2012) where it is explicitly stated that Pan & Sparks' study was conducted in China and that Brown et al.'s study is a cross-cultural study.

**Response:** Thank you for pointing out this issue. We would like to change our wording to make the expression more accurate and fairer. We should have phrased it as "our findings differ from the major traditional perception established in the literature where girls generally outperform boys in various moral and character development aspects. And our findings feed into the ongoing discourse on gender difference from a character lens." We have made this change in the text, page 16.

**Comment:** Therefore, being one of the questions of the study "Are there any culturally specific factors unique to Chinese culture in explaining these differences?" one would expect in the discussion more research or, in case there is no previous research, to comment on other Western research that has also found cultural differences, although not carried out in the Chinese context, in order to analyse how they explain these differences.

**Response:** Thank you for your comments. We believe there are specific factors unique to Chinese culture for explaining these differences, and we provided some discussions (e.g., on the expectations of women's appearance); however, because our data are based on surveys only, without other direct sources of materials, we cannot claim what exactly the
factors are other than offering some discussions based on experience and observations.

**Comment:** The authors note that “The majority of the participants were single children in the family, resulting from the "one-child" policy” (p.5). Have the authors considered how this influences the development of character strengths? Most of the character strengths are relational in themselves or develop in relation to other people, so this should be considered, also taking into account the importance of the family in character education. Other questions also arise: To what extent does this condition influence the findings of the study? Is there any previous research involving only children in the study of gender differences in character strengths in China or other countries?

**Response:** Thank you for noticing that our sample - the student participants - are mostly single children within their families. Frankly, we did not give special attention to it and its impact on children's character development since the relevant policy was launched back in 1980 - it has become a common phenomenon in China that each family typically has one child. Only recently has this policy been revised. It is possibly true that if children have brothers and/or sisters, their experiences would be different from those who are the only child in the family, as they are facing more situations where they need to learn to share with their peers or deal with conflicts with their peers. We have found that there are some comparative studies between one-child families and other kinds. For example, research (皇甫艳玲, 2008) shows that the moral status of only-child college students is weakened compared with other group; another study (董巧凤,郭正武, 2001) shows that only-child college students have stronger self-awareness, openness and various other characteristics. To return to the current study, it is hard to determine to what extent the sample of predominantly no-sibling children has affected the findings, as we do not have the parallel samples of children who have brothers and/or sisters. It would be something interesting to explore in future studies. We have added a footnote on page 12.

Last but not least, we would like to thank the two professors for their constructive comments and for making valuable points that not only help improve our current manuscript but also benefit future studies.

Sincerely, Authors

**Competing Interests:** n/a
This study explores gender differences in character strength among Chinese preadolescents and adolescents, using a sample of primary and secondary school students in Beijing. The paper does a relatively informative literature study and attempts to dialogue with some of the findings in the Western context, the instruments used are well described, and the data analysis methods used are credible and relatively novel. Some of the ideas in the paper, such as the revelation that women are more sensitive to moral imperatives from within, while men are more sensitive to moral imperatives from outside, are also illuminating.

However, the main conclusion from this research, that Chinese girls' character strengths are mainly in curiosity and Chinese boys' character strengths are mainly in open-mindedness, is not very convincing. Because, in the general sense, curiosity and open-mindedness seem to be correlated. Therefore, the conclusion that a group has a strong curiosity but not enough open thinking still sounds rather strange. The reason for this is that the instrument used in the study to measure character strength may be slightly flawed to some extent. Specifically, the personality traits extracted from the conduct code of primary and secondary school students, although novel, are rather one-sided and do not reflect the unique characteristics of a particular character strength. For example, open-mindedness, which is mainly reflected in the code for primary and secondary school students, is the ability to accept criticism from others, which is obviously closer to the quality of humility. Therefore, this item is not enough to measure open-mindedness. Also, the curiosity in the student code of conduct is mainly reflected in the willingness to explore science, but only this question is obviously not enough to reflect the essential characteristics of curiosity. If the paper could combine the qualities extracted from the student code of conduct with the more mature test questionnaire of the VIA-Youth measure to form a hybrid questionnaire with higher reliability and validity, the data might be more convincing.

In addition, curiosity and open-mindedness seem to be insufficient for revealing gender differences in students' moral character qualities. Also, situational explanations of this difference seem to be missing some key factors. In the Chinese scenario, curiosity and open-mindedness are closely related to students' achievement. In general, students who are more curious and open-minded also tend to be better academic achievers. Because of the exam-oriented educational context in China, academic performance should be an important factor influencing students' character in terms of knowledge seeking or wisdom. Or, if we do it more carefully, perhaps we will find that the important influencing factor behind the impact of curiosity and open-mindedness is academic achievement, not gender. It is suggested to take academic performance as an important situational factor into consideration in the discussion.

Is the work clearly and accurately presented and does it engage with the current literature?  
Yes

Is the study design appropriate and does the work have academic merit?  
Yes

Are sufficient details of methods and analysis provided to allow replication by others?  
Yes

Are all the source data and materials underlying the results available?  
Yes
If applicable, is the statistical analysis and its interpretation appropriate?
I cannot comment. A qualified statistician is required.

Are the conclusions drawn adequately supported by the results?
Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** moral education, philosophy of education

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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Author Response 10 Oct 2022

Yan Huo, Tsinghua University, Beijing, China

**Comment:** This study explores gender differences in character strength among Chinese preadolescents and adolescents, using a sample of primary and secondary school students in Beijing. The paper does a relatively informative literature study and attempts to dialogue with some of the findings in the Western context, the instruments used are well described, and the data analysis methods used are credible and relatively novel. Some of the ideas in the paper, such as the revelation that women are more sensitive to moral imperatives from within, while men are more sensitive to moral imperatives from outside, are also illuminating.

**Response:** Dear Professor Hongyan, First of all, thank you so much for your valuable comments on our manuscript. We are particularly thankful for your recognition of our efforts to bridge the dialogue between Chinese and Western character education.

**Comment:** However, the main conclusion from this research, that Chinese girls' character strengths are mainly in curiosity and Chinese boys' character strengths are mainly in open-mindedness, is not very convincing. Because, in the general sense, curiosity and open-mindedness seem to be correlated. Therefore, the conclusion that a group has a strong curiosity but not enough open thinking still sounds rather strange.

**Response:** Thank you for pointing out that “curiosity and open-mindedness seem to be correlated”. We agree with you that they are, or at least may be, correlated; however, we believe that they are not the same, neither generally nor as seen through a character lens. From a general perspective, by looking at the meaning from dictionaries, curiosity means “desire to know: inquisitive interest in others' concerns, or interest leading to inquiry” (Merriam-Webster Online Dictionary), an eager wish to know or learn about something (Cambridge Online Dictionary). Meanwhile, open-mindedness means being “receptive to arguments or ideas” (Merriam-Webster Online Dictionary), or the quality of being willing to consider ideas and opinions that are new or different from your own (Cambridge Online Dictionary). There is a sharp difference here, solely by examining the general meaning of the two. If we turn to the existing literature, more evidence can be found. For example, curiosity is a quality related to inquisitive thinking such as exploration, investigation, and learning, evident by observation in humans and other animals (Berlyne, 1954; 1955). Open-mindedness relates to the way in which people approach the views and knowledge of
others (Mitchell & Nicholas, 2006). Jack Kwong’s (2015) definition sees open-mindedness as the “willingness to take a novel viewpoint seriously”. Jason Baehr (2011) defines an open-minded person as one who “characteristically moves beyond or temporarily sets aside his own doxastic commitments in order to give a fair and impartial hearing to the intellectual opposition”. On the one hand, curiosity clearly does not imply being willing to set aside one’s own beliefs or views; on the other hand, curiosity can also be associated with “nosiness” when one is interested in others’ concerns - which can be perceived as a negative trait. Therefore, it is perfectly possible that one is curious enough but not being open-minded enough.

**Comment:** The reason for this is that the instrument used in the study to measure character strength may be slightly flawed to some extent. Specifically, the personality traits extracted from the conduct code of primary and secondary school students, although novel, are rather one-sided and do not reflect the unique characteristics of a particular character strength. For example, open-mindedness, which is mainly reflected in the code for primary and secondary school students, is the ability to accept criticism from others, which is obviously closer to the quality of humility. Therefore, this item is not enough to measure open-mindedness. Also, the curiosity in the student code of conduct is mainly reflected in the willingness to explore science, but only this question is obviously not enough to reflect the essential characteristics of curiosity. If the paper could combine the qualities extracted from the student code of conduct with the more mature test questionnaire of the VIA-Youth measure to form a hybrid questionnaire with higher reliability and validity, the data might be more convincing.

**Response:** With regard to the instrument, we cannot help agreeing with Professor Hongyan that it is not perfect - thank you for pointing it out. However, this is due to the constraints of the original code items. The character traits we extracted, such as “open-mindedness” or “curiosity”, are based on specific code items only; therefore, those are not character traits that cover the wholeness of a student’s character. Nevertheless, this terminology is still valid in reflecting the level of character that it is based on the original items. We have added one more point in our limitation section: the character strengths examined in our study were extracted from the code items and thus constrained by the code (P. 21). Future studies should consider applying character strengths measures such as VIA-Youth, or a hybrid measure that combined the codes character strengths and the VIA-Youth, just like the reviewer suggested. In addition, based on the above meaning analysis of open-mindedness, we consider “the ability to accept criticism from others” as being well associated with open-mindedness, although it also quite close to the meaning of humility when referring to the quality or state of being humble - we have added a footnote on page 31, to clarify this point. As Ruch, & Proyer (2015) suggest that the strengths were often markers for two or even three virtues, and occasionally they marked the other virtue more strongly than the one they were assigned to. The (possibly controversial) naming of the character trait was not decided by a single author, but a group decision by three authors (cf. Huo et al., 2021). Professor Hongyan also suggested that if the paper could combine the qualities extracted from the student code of conduct with the more mature test questionnaire of the VIA-Youth measure to form a hybrid questionnaire with higher reliability and validity, the data might be more convincing. We appreciate this suggestion, and it would be something that we would like to try in our future studies. This would be in line with our general research agenda of bridging the gap between Western and Chinese character studies.
**Comment:** In addition, curiosity and open-mindedness seem to be insufficient for revealing gender differences in students’ moral character qualities. Also, situational explanations of this difference seem to be missing some key factors. In the Chinese scenario, curiosity and open-mindedness are closely related to students’ achievement. In general, students who are more curious and open-minded also tend to be better academic achievers. Because of the exam-oriented educational context in China, academic performance should be an important factor influencing students’ character in terms of knowledge seeking or wisdom. Or, if we do it more carefully, perhaps we will find that the important influencing factor behind the impact of curiosity and open-mindedness is academic achievement, not gender. It is suggested to take academic performance as an important situational factor into consideration in the discussion.

**Response:** We would also like to thank Professor Hongyan for pointing out the missing factor of the exam-oriented educational context in China. Nevertheless, we cannot jump to the conclusion that the most salient perceived impact of curiosity and open-mindedness is academic achievement. For example, children at the age of 3-6, when there are no exam pressures yet can still be curious and open-minded. So how can we be certain, when students are at primary or secondary school, that their curiosity and open-mindedness are associated with academic results? All what we can say in this study is based on what the data tell us. We are well aware, however, that there are some limitations in the data set itself, and we would like to address these challenges in future studies.

All in all, we would like to express our sincere gratitude to Professor Hongyan for her important and valuable comments.
Sincerely, Authors

**Competing Interests:** n/a