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Gender reality on multi-domains of school-age children in Taiwan: A developmental approach

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ABSTRACT

This study addresses developmental trends in gender reality for 6–17 year-old children (a total of 16,322 males and 15,412 females) in Taiwan. Typically, large, representative and normative data sets for 11 cognitive and affective tests were analyzed. Results revealed that gender differences in personality, interest, and learning styles were fairly stable across age levels. Cognitive advantages for each gender, however, varied with developmental phase. The hypothesis of "greater male variability" was supported in most domains. Consideration of compounded and accumulative effects may be crucial for explaining gender reality in outcome behaviors and career choices.

1. Introduction

Gender is the variable categorizing people into the largest subpopulations. Various biological and social variables vary as a function of gender. Some of these differences may have substantial psychological, educational, or social importance and consequences (Davies & Shackelford, 2006; Zuriff, 2006). As researchers interested in investigating the ways individuals differ, we have followed Lippa's (2006) recommendation in seeking a balanced perspective when recognizing both gender differences and gender similarities, or so called 'gender reality'. As Halpern (2000, p. 8) noted "differences are not deficiencies, and it is only through careful study of differences that similarities can be revealed".

In recent literature, the following suggestions are highlighted as important for further research into gender comparisons: (1) use data from large samples, including test-norming data as well as data from major national surveys (Hyde, 2005); (2) use up-to-date data (Hyde, 2005); (3) use comprehensive measures to explore sex differences from youth into early adulthood as compared to the widespread reliance in college-aged and adult samples (Camarata & Woodcock, 2006); (4) identify developmental trends in the magnitude of gender differences (Halpern, 2000; Hyde, 2005); (5) investigate the hypothesis of male greater variability (Halpern, 2000); and (6) use cross-cultural data as a resource for addressing the nature–nurture puzzle (Eagly & Wood, 1999; Lippa, 2005).

We investigated gender reality for school-age children in Taiwan across a range of cognitive and affective domains. Recent data from large samples were analyzed. Differences in both means and variances were studied across four age levels to provide a view of developmental trends.

2. Method

Large and recent data sets of Taiwanese children (altogether, 16,322 males and 15,412 females) aged 6–17 were collected separately via 11 psychological tests. These tests are psychometrically developed to measure individual traits across various domains. Table 1 summarizes characteristics of tests and data sets.

Among these 11 tests, 8 are internationally-sound widely used tests. These tests are adapted for use in Taiwan and have reliabilities similar to American versions (check references in Table 1 for details). The three locally developed tests and their alpha coefficients are as follows: Test of Critical Thinking Skills for Primary and Secondary school Students (TCTS-PS) (alpha = .80); Saying no to inappropriate requests (Alpha range between .90 and .93); and General Interest Inventory (GII) (Alpha range between .60 and .88 for various subscales).

During the past 6 years, we adapted six of the international tests for use in Taiwan and developed one of the local tests (Chang & Chen, 2002, 2009b). Therefore, we had full access to the primary data sets. For the remaining four tests, we personally collected individual scores from year 2003 to 2008 school records for two tests (Bennett, Seashore, & Wesman, 1999; Lu & Chen, 1997), and

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Table 1
The 11 psychometric tests used in study of the development of gender reality in school-aged children in Taiwan.

	Test type		Data source		Sample size			Test source
	International	Local	Primary	Secondary	All	Males	Females	
Tests for cognitive abilities								
1. Wechsler Intelligence Scale for Children-IV (WISC-IV)	–		–[b]		968	484	484	Wechsler (2007)
2. Otis-Lennon School Ability Test-VIII (OLSAT-VIII)	–		–[a,b]	–[a,b]	5,346	2,659	2,687	Otis and Lennon (2006) Otis and Lennon (2008)
3. Differential Aptitude Test-V (DAT-V)	–		–		2,001	1,133	868	Bennett et al. (1999)
4. Raven's progressive matrices	–		–[b]		7,284	3,841	3,443	Raven, Raven, and Court (2006)
5. Watson–Glaser Critical Thinking Appraisal (W–G)	–		–[b]		2,180	1,087	1,093	Watson and Glaser (in press)
6. Test of Critical Thinking Skills for Primary and Secondary School Students (TCTS-PS)		–		–	1,125	582	543	Yeh, Yeh, and Hsieh (2000)
Tests for affective attributes								
1. Beck Youth Inventories-II (BYI-II)	–			–[b]	2,177	913	1,264	Beck et al. (2008)
2. Student Style Questionnaire (SSQ)	–		–		1,946	875	1,071	Oakland, Glutting, and Horton (1996) Chang and Chen (2009a)
3. The Gordon Personal Profile Inventory (GPP-I)	–		–[b]		2,616	1,460	1,156	Gordon (2008)
4. Saying no to inappropriate requests		–	–[b]		1,809	799	1,010	Chang and Chen (2002, 2009b)
5. General Interest Inventory (GII)		–	–		4,282	2,489	1,793	Lu and Chen (1997)

[a] OLSAT-VIII data are primary data for age 9–14, and secondary data for age 15–17.
[b] Text-norming data which are well represent the Taiwan population.

retrieved means and standard deviations reported in test manuals or academic articles for the remaining two tests (Beck, Beck, Jolly, & Steer, 2008; Yeh, Yeh, & Hsieh, 2000). Readers interested in a brief description of the adaptation and development process of each test may contact the corresponding author.

To investigate developmental trends, we divided the children into four age levels: age 6–8, age 9–11, age 12–14, and age 15–17. These levels roughly correspond to early-to-middle elementary school, middle-to-late elementary school, middle school, and high school cohorts. We made a total of 205 comparisons by examining gender differences for each trait at each age level. Of results reported here, 89% were based on analyzing real individual data, and 11% were derived from documented means and standard deviations.

For each comparison, we investigated differences in both mean and variance. The effect size was evaluated by Cohen's *d* (Cohen, 1988) where the positive *d* values indicate that males score higher. A variance ratio (VR), the ratio of male variance to the female variance (Hyde, 2005), greater than one represented greater variability in males. Readers may contact corresponding author for Appendix A, which lists details of means and standard deviations for all comparisons and number of males and females in each age level.

3. Results and discussion

Cohen's *d* and variance ratios for the abilities in the cognitive domain are shown in Table 2 and for the affective attributes in Table 3. Following Hyde (2005), *d* values greater than 0.10 and less than 0.35 were classified as small. Those over 0.66 were classified as large. In both Tables 2 and 3, values larger than 0.10 are in bold type to highlight gender effects.

3.1. Gender reality at age 6–8

Young boys seem to surpass their female classmates in many fundamental cognitive domains, except for information processing speed. Boys at this young age were better at general learning ability, verbal-concept formation, vocabulary meaning, verbal reasoning, general information, visual–spatial and perceptual reasoning, digit span short-term memory, and mentally solving arithmetic questions. In the affective domains, boys showed more rule-violating behaviors and girls showed more negative emotions such as depression and anxiety.

3.2. Gender reality at age 9–11

After a few years of formal schooling, the pervasive male advantage found for boys aged 6–8 diminished. Girls began to show superior performance in many cognitive domains. Although boys still showed greater general knowledge and mental ability for solving arithmetic questions, their verbal ability was no longer superior. In fact, girls outperformed boys in general learning ability, nonverbal reasoning, working memory, and processing speed. Regarding affective attributes, girls showed slightly stronger levels of depression and had more organized and feeling-oriented styles. Boys expressed more imaginative, flexible, and thinking-oriented styles and showed more rule-violating behaviors. The interests of each gender were quite different. Boys showed stronger preferences for mechanical and scientific activities. Girls found inter-personal activities more attractive. Girls also showed stronger interests in literary, artistic, clerical, and computational activities.

3.3. Gender reality at age 12–14

The clear differences in interest, learning style, and personality for each sex remained fairly stable. Cognitive patterns, however, seem to diverge at this period. Girls begin to excel at various verbal abilities, such as verbal reasoning, comprehension for social events, grammar, and word error recognition. Boys continued to outperform girls in working memory and nonverbal abilities, such as picture concepts and nonverbal, mechanical, and numerical reasoning.

3.4. Gender reality at age 15–17

Here, gender differences in affective domains were the same as observed in the younger cohorts. The magnitude of girls' negative emotions increased at this age. In addition, boys began to excel at abstract, mechanical, numerical, and verbal reasoning and at

Table 2
Cohen's d and variance ratio (in parenthesis) for cognitive abilities of grade-school children in Taiwan.

	Age 6–8	9–11	12–14	15–17
Intelligence				
WISC-IV Full scaled IQ	**0.17** (1.07)	−**0.19** (0.93)	−0.01 (1.02)	−0.08 (1.15)
OLSAT School ability	–	0.02 (1.02)	−**0.12** (1.29)	0.02[a] (1.21)
Verbal abilities				
WISC-IV Verbal Comprehension Index	**0.20** (1.08)	−0.03 (0.91)	−0.03 (1.17)	−0.05 (1.11)
WISC-IV Similarities	**0.21** (1.16)	−0.06 (1.01)	0.03 (1.17)	−0.03 (0.93)
WISC-IV Vocabulary	**0.24** (1.16)	0.03 (1.04)	0.04 (1.06)	−0.04 (1.04)
WISC-IV Comprehension	0.04 (0.96)	−0.02 (0.83)	−**0.17** (0.99)	−0.09 (1.26)
WISC-IV Information	**0.12** (1.45)	**0.13** (1.27)	**0.19** (1.27)	0.05 (0.93)
OLSAT Verbal reasoning	–	−0.04 (1.02)	−**0.17** (1.23)	0.01[a] (1.27)
DAT-V Verbal reasoning	–	–	−0.08 (1.14)	**0.22** (0.83)
DAT-V Chinese word error recognition	–	–	−**0.21 (1.20)**	−0.07 (0.79)
DAT-V Chinese grammar	–	–	−**0.32 (1.45)**	−0.04 (0.75)
Nonverbal abilities				
WISC-IV Perceptual Reasoning Index	**0.19** (1.12)	−**0.14** (0.96)	0.06 (1.03)	0.05 (1.11)
WISC-IV Matrix reasoning	0.04 (0.83)	−**0.13** (1.08)	−0.02 (1.07)	0.07 (0.99)
WISC-IV Block Design	**0.36** (1.47)	0.02 (1.02)	0.02 (0.95)	−0.02 (1.61)
WISC-IV Picture concept	0.07 (1.07)	−**0.20** (0.83)	**0.13** (1.04)	0.06 (0.72)
WISC-IV Picture Completion	0.03 (1.18)	0.07 (1.06)	**0.20** (1.24)	**0.22** (1.02)
OLSAT Nonverbal reasoning	–	0.07 (1.01)	−0.05 (1.28)	**0.13**[a] (1.12)
Raven's Progressive matrices	0.07 (0.88)	−**0.12** (1.28)	0.08 (1.18)	**0.13** (1.34)
DAT-V Abstract reasoning	–	–	0.04 (1.35)	**0.42** (1.30)
DAT-V Mechanical reasoning	–	–	**0.27** (1.24)	**0.49** (1.51)
DAT-V Numerical reasoning	–	–	**0.19** (1.16)	**0.33** (1.09)
DAT-V Space relation	–	–	0.02 (1.14)	**0.20** (1.35)
Critical thinking				
W-G Critical thinking	–	–	–	**0.19** (1.16)
TCTS-PS Critical thinking[a]	–	0.08 (0.97)	−**0.10** (1.23)	–
Working memory				
WISC-IV Working Memory Index	0.06 (1.09)	−**0.17** (0.80)	**0.24** (1.04)	0.01 (1.33)
WISC-IV Letter-number sequence	0.01 (1.26)	−**0.25** (0.87)	**0.22** (1.06)	0.04 (1.40)
WISC-IV Digit span	**0.13** (0.96)	−0.07 (0.97)	**0.22** (1.12)	−0.01 (1.28)
WISC-IV Digit span-forward	**0.14** (0.79)	−**0.11** (0.94)	**0.10** (0.88)	0.07 (0.99)
WISC-IV Digit span-backward	0.03 (1.06)	0.01 (0.95)	**0.20** (1.34)	−**0.10** (1.53)
WISC-IV Arithmetic	**0.20** (1.20)	**0.13** (1.59)	**0.36** (1.01)	**0.10** (1.49)
Processing speed				
WISC-IV Processing Speed Index	−0.03 (1.10)	−**0.32** (0.90)	−**0.25** (1.03)	−**0.31** (1.19)
WISC-IV Coding	−**0.14** (1.13)	−**0.30** (0.88)	−**0.28** (1.02)	−**0.30** (1.07)
WISC-IV Symbol search	0.09 (0.97)	−**0.26** (1.02)	−**0.16** (1.14)	−**0.25** (1.21)
WISC-IV Cancellation	0.04 (1.32)	−0.03 (1.32)	0.09 (1.01)	**0.31** (0.89)
DAT-V Perceptual speed and accuracy	–	–	0.02 (1.34)	**0.47** (0.95)

[a] Based on reported M and SD.

spatial mental rotations. Interestingly, boys even began to show faster speed in processing meaningful stimuli such as figures, numbers, and letters. At this age, however, working memory was no longer greater in boys. Although girls continued to show higher processing speeds on stimuli without specific meanings, their earlier advantages in verbal performance seemed to decrease.

3.5. Trends of gender differences across age levels

Our results revealed that some, but not all, gender differences were stable as age increased. Styles of personality, learning styles, emotions, and interests expressed in early elementary school seemed to remain unchanged as the children developed. Lippa (1998, 2005) also reported large gender differences in affective attributes. Gender differences in emotions were found to occur as early as preschool (Chaplin, Cole, & Zahn-Waxler, 2005). Differences in personality traits were also robust across cultures and more pronounced as human society developed (Costa, Terracciano, & McCrae, 2001; Schmitt, Realo, Voracek, & Allik, 2008). Therefore, gender differences in affective attributes may be enduring and built-in.

There were several stable cognitive patterns. Girls showed steady superiority at speed of processing symbolic visual stimuli, especially at transferring paired visual symbols. This result is consistent with Camarata & Woodcock's (2006) findings that boys score significantly lower on Gs (processing speed factor) in the Woodcock–Johnson series of cognitive and achievement batteries. At age 6–14, boys consistently outperformed girls in mentally solving arithmetic questions and gathering general knowledge or information. Hyde (2005) demonstrated that males perform better at mathematical problem solving. Cross-cultural studies also show that males have more general information or broader knowledge than females (Lynn, Fergusson, & Horwood, 2005; Lynn, Irwing, & Cammock, 2001).

Age played an essential role in development of cognitive abilities. Young boys aged 6–8 had an early advantage in verbal, nonverbal, and working memory domains. By age 9–11, girls were not only catching up with boys on verbal abilities, they were becoming superior in almost all domains including nonverbal ability and working memory. In elementary school, this transformation from "early male superiority" to "female advantage" was quite striking. We speculated that both physiological maturation and schooling were important for this transition. Girls mature more rapidly neurologically than boys until age 15 (Lynn, 1999). Girls also approach schoolwork with a better learning attitude (Kenney-Benson, Pomerantz, Ryan, & Patrick, 2006), are more self-disciplined (Duckworth & Seligman, 2006), and earn higher grades than boys in all major subjects (Perkins, Kleiner, Roey, &

Table 3
Cohen's *d* and variance ratio (in parenthesis) for affective attributes of grade-school children in Taiwan.

	Age			
	6–8	9–11	12–14	15–17
Personality and learning styles				
BYI-II Depression [a]	−**0.24** (0.72)	−**0.17** (0.99)	−**0.17** (0.99)	−**0.19** (1.40)
BYI-II Anxiety[a]	−**0.17** (0.99)	−0.04 (1.30)	−0.04 (1.30)	−**0.26** (1.26)
BYI-II Angry[a]	−0.02 (0.93)	−0.04 (0.95)	−0.04 (0.95)	−0.16 (1.39)
BYI-II Violating rules [a]	**0.33** (1.51)	**0.34** (1.76)	**0.34** (1.76)	**0.10** (1.20)
BYI-II Self concept [a]	−0.04 (1.02)	**0.10** (1.10)	**0.10** (1.10)	0.04 (1.40)
SSQ Extravert	–	−0.09 (0.97)	−0.06 (0.88)	−0.03 (0.93)
SSQ Introvert	–	0.06 (0.95)	0.04 (0.87)	−0.01 (0.98)
SSQ Practical	–	−**0.10** (1.31)	−**0.17** (0.97)	−0.06 (1.06)
SSQ Imaginative	–	**0.12** (1.26)	**0.17** (1.06)	0.10 (1.08)
SSQ Thinking	–	**0.72** (1.24)	**0.66** (1.19)	**0.68** (1.21)
SSQ Feeling	–	−**0.72**(1.31)	−**0.71** (1.29)	−**0.75** (1.28)
SSQ Organized	–	−**0.34**(1.41)	−**0.33** (1.02)	−**0.34** (1.05)
SSQ Flexible	–	**0.32** (1.37)	**0.28** (1.09)	**0.36** (1.04)
Saying no to inappropriate requests	–	−0.03 (0.95)	−**0.33** (1.52)	−**0.49** (1.25)
GPP-I Ascendancy	–	–	–	**0.10** (1.13)
GPP-I Responsibility	–	–	–	−0.09 (1.02)
GPP-I Emotional stability	–	–	–	**0.24** (0.94)
GPP-I Sociability	–	–	–	−0.07 (1.03)
GPP-I Self Esteem	–	–	–	0.07 (1.07)
GPP-I Cautiousness	–	–	–	0.08 (0.90)
GPP-I Original thinking	–	–	–	**0.13** (1.02)
GPP-I Personal relation	–	–	–	**0.11** (0.93)
GPP-I Vigor	–	–	–	−0.05 (1.01)
Interests				
GII Mechanical interest	–	**0.37** (1.20)	**0.70** (1.68)	**0.81** (1.66)
GII Scientific interest	–	**0.36** (1.25)	**0.41** (1.43)	**0.37** (1.36)
GII Computational interest	–	−**0.21** (1.04)	0.00 (1.02)	−0.05 (1.03)
GII Teaching interest	–	−**0.68** (0.89)	−**0.34** (1.00)	−**0.42** (1.00)
GII Persuasive interest	–	−**0.44** (0.88)	−**0.43** (0.95)	−**0.45** (1.07)
GII Social service	–	−**0.57** (1.37)	−**0.36** (1.04)	−**0.44** (1.04)
GII Musical interest	––	−**0.92** (1.04)	−**0.69** (0.75)	−**0.48** (0.82)
GII Artistic interest	–	−**1.18** (1.14)	−**0.64** (0.88)	−**0.44** (0.97)
GII Literary interest	–	−**0.39** (0.98)	−**0.49** (0.79)	−**0.35** (0.85)
GII Clerical interest	–	−**0.61** (0.76)	−**0.64** (0.72)	−**0.59** (0.90)
GII Outdoor interest	–	−**0.41** (1.23)	−0.06 (1.23)	−0.01 (1.35)

[a] Based on reported M and SD.

Brown, 2004; Pomerantz, Altermatt, & Saxon, 2002). Although cognitive abilities can be improved by education (Halpern, 2004), the advantages listed here may drive this transition to female advantage at ages 9–11.

By puberty, gender differences were marked. Adolescence is a time of great change. The patterns of "female-verbal advantage" and "male-nonverbal advantage" became obvious. Although boys also showed better working memory, only the "male-nonverbal advantage" remained and strengthened for those aged 15–17. For this age group, gender differences in verbal ability and working memory became trivial. Lynn and Irwings' (2004) meta analysis on the progressive matrices across various countries found that males from the age of 15 years onwards have higher fluid intelligence, Camarata & Woodcock's (2006) reports based on the US Woodcock–Johnson normative scores, however, did not show this trend. As a growing body of biological evidences supports sex differences in brain structure and function (Halpern et al., 2007; Lippa, 2005), we suspect that psychological, biological, and cultural factors all play some roles on observed gender differences. Thus, we support the saying that a 'psychobiosocial model' (Halpern & LaMay, 2000) is needed to truly understand the underlying mechanisms.

3.6. The "greater male variability" hypothesis

The current results supported the hypothesis that male performance on tests of mental abilities and traits may be more variable than female performance as suggested by previous research (Strand, Deary, & Smith, 2006). Tables 2 and 3 show that most variation ratios, but not all, were greater than one. We found greater variation at older ages and for nonverbal ability, working memory, neurotic negative emotions, and mechanical-scientific interests. Results also revealed that females at all ages were constantly more variable in ability to attend and immediately recall temporally ordered elements (Digit Span-forward), extravert–introvert learning styles, and literacy-clerical interests.

4. Conclusion

Overall, our results supported the importance of viewing gender reality from a developmental perspective. Boys and girls developed stable and distinct affective characteristics at young ages. The magnitude and directions of gender differences for most cognitive abilities did vary across age levels. Nevertheless, several questions remained to be answered: Is there a universal "early male advantage?" How unique to Taiwanese culture is our finding of female advantage at age 9–11 given that Taiwanese parents tend to pay excessively high attention to the academic achievements of their children? What roles do sexual-hormones or frontal lobe development play in the changes in the cognitive profile at puberty? Why do gender differences in verbal ability and working memory diminish at ages 15–17?

On the basis of a review of 46 meta-analyses that showed most gender differences were small and non significant, Hyde (2005, 2006) advanced the similarities hypothesis. This holds that males and females are alike on most psychological variables.

Regardless of how small any single effect might be, however, the compounding effects of these small differences on human behavior or life choice could be complicatedly large. We should not under-estimate possible cumulative effects. For example, given that the gender gap in mathematical and scientific performances is closing, why is there still no parity in representation of males and females in the science-related professional fields (Spelke, 2005; Wickware, 1997)? As our findings revealed, on the average, males tended to develop to be more thinking-oriented and flexible. They had better general knowledge, were more emotionally stable, were better at reasoning, and less interested in teaching and persuading others. We also found "greater male variability" in several of these domains. Gridley (2006) pointed out that ability cannot explain everything. Thinking styles, such as thinking–feeling orientation, help an individual with career selection. One's preference and orientation toward people or things may play a crucial role in the kind of career one becomes interested in. As Feist (2006, p. 163) contended, "Imaging a scientist without a unique style of behavior and thinking is nearly impossible. Scientific interest and achievement have fascinating and complex developmental paths and are more likely to come from people with particular kinds of personalities and traits than with other kinds of personalities". Webb, Lubinski, and Benbow (2002) also suggested the effect of individual differences on influencing human decisions cannot be ignored. Equal gender representation across all educational–vocational domains may conflict with what might be happening naturally. Thus, "equal male–female representation across disciplines may not be as simple to accomplish as many policy discussions imply" (Webb et al., 2002, p. 785). As Halpern et al. (2007, p. 41) wonderfully concluded, "There is no single factor by itself that has been shown to determine sex differences in science and math. Early experience, biological constraints, educational policy, and cultural context each have effects, and these effects add and interact in complex and sometimes unpredictable ways".

For another example, girls have better grades in school, but why do girls constantly show lower self-esteem (Kling, Hyde, Showers, & Buswell, 1999; Major, Barr, Zubek, & Babey, 1999)? Our results led us to suspect that at ages 15–17, girls were less capable at reasoning and tended to think in a more organized, but less flexible manner. Those traits may cause them to perform worse when encountering unfamiliar problems. Besides, girls tended to feel more depressed and anxious. They were people-oriented and paid more attention to feelings. It is quite possible that girls tend to be less confident at heart, viewing and judging themselves through others' eyes. When facing stress, females tend to seek social support, but males tend to cope through direct action or avoidance (Eschenbeck, Kohlmann, & Lohaus, 2007). These findings confirmed the importance of external and social support on the innate well-being of females.

Some inevitable limitations of our study deserve attention. First, our findings were based on cross-sectional, not longitudinal, data. Thus, the cohort effect was not well-controlled. Although we were able to depict possible developmental variations because the data were representative and included large samples, we realize that only solid longitudinal data can confirm our findings. Second, since there is a shortage of appropriate psychometrically-sound tests for younger children, we were not able to track gender reality on several domains through all age levels. This meant we could not identify when boys and girls start showing their amazingly long-term stable affective patterns. Third, even if we did try to collect data from as complete domains as possible, omissions of other important individual difference traits are inescapable. Finally, since individual data set for each of the 11 psychological tests was analyzed, each child took one test only. We were not able to provide quantified evaluations on how these measures interacted across ages between boys and girls. This issue definitely can be followed up in future work.

In this study, we report on the most complete gender-comparison data for school-age children in Taiwan. Regardless of gender roles expected for males and females of the 21st century, objective data revealed themselves. Readers are encouraged to deliberate upon possible accumulated compounding effects, especially when treating gender differences of affective attributes as baselines, the outcome differences between genders in real life could be huge.

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References

Beck, J. S., Beck, A. T., Jolly, J. B., & Steer, R. A. (2008). *Beck youth inventories-II: Taiwanese manual*. Taipei, Taiwan: Chinese Behavioral Science Corporation.

Bennett, G. K., Seashore, H. G., & Wesman, A. G. (1999). *Differential aptitude tests-V: Taiwanese manual*. Taipei, Taiwan: Chinese Behavioral Science Corporation.

Camarata, S., & Woodcock, R. (2006). Sex differences in processing speed: Developmental effects in males and females. *Intelligence, 34*, 231–252.

Chang, T., & Chen, H. (2002). The relationship between saying no and personality among adolescents. *Psychological Testing, 49*(2), 133–153.

Chang, T., & Chen, H. (2009a). *Adaptation of the student style questionnaire in Taiwan*. Unpublished raw data.

Chang, T., & Chen, H. (2009b). *Saying no: Taiwanese manual*. Unpublished manuscript.

Chaplin, T. M., Cole, P. M., & Zahn-Waxler, C. (2005). Parental socialization of emotion expression: Gender differences and relations to child adjustment. *Emotion, 5*(1), 80–88.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Costa, P. T., Jr., Terracciano, A., & McCrae, R. R. (2001). Gender difference in personality traits across cultures: Robust and surprising findings. *Journal of Personality and Social Psychology, 81*(2), 322–331.

Davies, A. P. C., & Shackelford, T. K. (2006). An evolutionary psychological perspective on gender similarities and differences. *American Psychologist, 61*(6), 640–641.

Duckworth, A. L., & Seligman, M. E. P. (2006). Self-discipline gives girls the edge: Gender in self-discipline, grades, and achievement test scores. *Journal of Educational Psychology, 98*(1), 198–208.

Eagly, A. H., & Wood, W. (1999). The origins of sex differences in human behavior: Evolved dispositions versus social roles. *American Psychologist, 54*(6), 408–423.

Eschenbeck, H., Kohlmann, C., & Lohaus, A. (2007). Gender differences in coping strategies in children and adolescents. *Journal of Individual Differences, 28*(1), 18–26.

Feist, G. J. (2006). How development and personality influence scientific thought, interest, and achievement. *Review of General Psychology, 10*(2), 163–182.

Gordon, L. V. (2008). *Gordon personal profile-inventory (GPP-I)* (Taiwanese ed.). Taipei, Taiwan: Chinese Behavior Science Corporation.

Gridley, M. C. (2006). Cognitive styles partly explain gender disparity in engineering. *American Psychologists, 61*(7), 724–725.

Halpern, D. F. (2000). *Sex differences in cognitive abilities* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Halpern, D. F. (2004). A cognitive-process taxonomy for sex differences in cognitive abilities. *Current Directions in Psychological Science, 13*(4), 135–139.

Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest, 8*(1), 1–51.

Halpern, D. F., & LaMay, M. L. (2000). The smarter sex: A critical review of sex differences in intelligence. *Educational Psychology Review, 12*(2), 229–246.

Hyde, J. S. (2005). The gender similarities hypothesis. *American Psychologist, 60*(6), 581–592.

Hyde, J. S. (2006). Gender similarities still rule. *American Psychologist, 61*(6), 641–642.

Kenney-Benson, G. A., Pomerantz, E. M., Ryan, A. M., & Patrick, H. (2006). Sex differences in math performance. The role of children's approach to schoolwork. *Developmental Psychology, 42*(1), 11–26.

Kling, K. C., Hyde, J. S., Showers, C. J., & Buswell, B. N. (1999). Gender differences in self-esteem: A meta-analysis. *Psychological Bulletin, 125*, 470–500.

Lippa, R. A. (1998). Gender-related individual difference and the structure of vocational interests: The importance of the "people-things" dimension. *Journal of Personality and Social Psychology, 74*, 996–1009.

Lippa, R. A. (2005). *Gender, nature, and nurture* (2nd ed.). Mahwah, NJ: Erlbaum.

Lippa, R. A. (2006). The gender reality hypothesis. *American Psychologist, 61*(6), 639–640.

Lu, J., & Chen, S. (1997). *General interest inventory: Taiwanese manual*. Taipei, Taiwan: Chinese Behavior Science Corporation.

Lynn, R. (1999). Sex differences in intelligence and brain size: A developmental theory. *Intelligence, 27*(1), 1–12.

Lynn, R., Fergusson, D. M., & Horwood, L. J. (2005). Sex differences on the WISC-R in New Zealand. *Personality and Individual Differences, 39*, 103–114.

Lynn, R., & Irwing, P. (2004). Sex differences on the progressive matrices: A meta-analysis. *Intelligence, 32*, 481–498.

Lynn, R., Irwing, P., & Cammock, T. (2001). Sex differences in general knowledge. *Intelligence, 30*, 27–39.

Major, B., Barr, L., Zubek, J., & Babey, S. H. (1999). Gender and self-esteem: A meta-analysis. In W. B. Swann, J. H. Langlois, & L. A. Gilbert (Eds.), *Sexism and stereotypes in modern society: The gender science of Janet Taylor Spence* (pp. 223–253). Washington, DC: American Psychological Association.

Oakland, T., Glutting, J. J., & Horton, C. B. (1996). *Student styles questionnaire*. San Antonio, TX: The Psychological Corporation.

Otis, S., & Lennon, R. T. (2006). *Otis-Lennon school ability test: Taiwanese manual for children level* (8th ed.). Taipei, Taiwan: Chinese Behavior Science Corporation.

Otis, S., & Lennon, R. T. (2008). *Otis-Lennon school ability test: Taiwanese manual for senior high school level* (8th ed.). Taipei, Taiwan: Chinese Behavior Science Corporation.

Perkins, R., Kleiner, B., Roey, S., & Brown, J. (2004). *The high school transcript study: A decade of change in curricula and achievement, 1990–2000 (Report No. NCES 2004455)*. Washington, DC: US Department of Education, National Center for Education Statistics.

Pomerantz, E. M., Altermatt, E. R., & Saxon, J. L. (2002). Making the grade but feeling distressed: Gender differences in academic performance and internal distress. *Journal of Educational Psychology, 94*, 396–404.

Raven, J., Raven, J. C., & Court, J. H. (2006). *Raven's progressive matrices: Taiwanese manual*. Taipei, Taiwan: Chinese Behavior Science Corporation.

Schmitt, D. P., Realo, A., Voracek, M., & Allik, J. (2008). Why can't a man be more like a woman? Sex differences in big five personality traits across 55 cultures. *Journal of Personality and Social Psychology, 94*(1), 168–182.

Spelke, E. S. (2005). Sex differences in intrinsic aptitude for mathematics and science? A critical review. *American Psychologist, 60*(9), 950–958.

Strand, S., Deary, I. J., & Smith, P. (2006). Sex differences in cognitive abilities test scores: A UK national picture. *British Journal of Educational Psychology, 76*, 463–480.

Watson, G., & Glaser, E. M. (in press). *Watson–Glaser critical thinking appraisal: Taiwanese manual*. Taipei, Taiwan: Chinese Behavioral Science Corporation.

Webb, R. M., Lubinski, D., & Benbow, C. P. (2002). Mathematically facile adolescents with math-science aspirations: New perspectives on their educational and vocational development. *Journal of Educational Psychology, 94*(4), 785–794.

Wechsler, D. (2007). *Wechsler intelligence scale for children: Taiwanese manual* (4th ed.). Taipei, Taiwan: Chinese Behavioral Science Corporation.

Wickware, P. (1997). Along the leaky pipeline. *Nature, 390*, 202–203.

Yeh, Y., Yeh, P., & Hsieh, C. (2000). The development of "the test of critical-thinking skills for primary and secondary school students". *Psychological Testing, 47*(1), 27–46.

Zuriff, G. E. (2006). Judgments of similarity are psychological: The importance of importance. *American Psychologist, 61*(6), 641.