

Letter

Gender Stereotypes Observed in Dizygotic Twins Before Elementary School Enrollment: A Preliminary Case Study Using Color Analysis of Coloring Pictures Homework at a Japanese Supplementary School in the United States

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Purpose: Gender issues have become a crucial topic in bioethics^{1,2}. This study provides insights into the formation of children's gender stereotypes (GSs) in multilingual educational settings involving Japanese and English. The study's primary focus is cross-cultural gender studies.

Participants and Methods: Male and female dizygotic twins participated. By employing a twin design, we adjusted for 1) genetic factors (bias) among research participants to the greatest extent possible, and 2) environmental factors (bias) because of their upbringing in nearly identical home environments. From January to March 2025, Japanese language classes for preschoolers (under 6-year-old) were held at a Japanese supplementary school in the US (7 students, 90 minutes weekly). Classes included reading and writing kana, conversation, seasonal events, etc. A cross-sectional qualitative analysis was conducted on the colors chosen by the participants for two coloring pictures assigned as homework. To rule out the possibility that individual differences in color preferences, which participants might inherently possess, influenced the results of

the gender-related tasks (skirt and pants), both gender-related tasks (skirt and pants) and a non-gender control (snake) group were incorporated. The participants' mother was a Japanese native but they were raised primarily in an English-speaking environment. Written informed consent was obtained from both parents.

Results: Table 1 and Figures 1 to 4. Different colors were observed in the skirt and pants drawn by the male participant. *Randoseru* (backpacks) were colored black. The non-gender control zodiac snakes were in intermediate colors.

Discussion: Only the male participant drew a red skirt for the girl and dark-brown pants for the boy, providing circumstantial evidence of existing GSs. This supports the developmental perspective that GSs emerge around ages 4 - 7³. In the non-gender control (snake) group, the girl did not heavily use red or pink colors associated with femininity, and the boy did not heavily use achromatic colors like black, associated with masculinity. In the non-gender control (snake) group, both participants used the same intermediate color. This suggests that it is unlikely that the

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participants' pre-existing color preferences influenced or were manifested in the results of the gender-related tasks (skirt and pants). Moreover, this difference in norm formation is intriguing—it may stem from female-male differences. The norm of associating warm colors (red and pink) with femininity and cool colors (blue and navy) or achromatic colors (white and black) with masculinity has been observed in countries beyond Japan⁴. Therefore, the extent to which Japanese cultural elements contributed to the development of GSs in the male participant remains unclear.

Notably, both participants used black for *randoseru*. While *randoseru* colors have become more flexible recently in Japan, in 2021, girls tended to select red, light purple, or pink (61.9%), while boys chose black, navy, or blue (88.7%)⁵. The current results contradicted this expectation. Possible reasons include 1) elementary school students rarely use *randoseru* in the US, so the participants had no exposure to the colors chosen by older students; 2) pictograms (toilet signs, etc.) are typically color-coded in Japan (women: red or pink; men: black or blue), however, color-coding is less common in the US; and 3) situations where gender is distinguished by color are becoming increasingly rare in the US.

This study suggests that growing up in a cultural and linguistic environment with multiple gender norms leads to the formation of “multicultural hybrid (chimera-like)” GSs. “Multicultural hybrid (chimera-like) GSs” refers, in this example, to the GSs formed by children raised under environments influenced by both Japanese GSs (girls wear red or pink; boys wear black or white) and American GSs (both girls and boys can freely choose colors). These children are neither typically Japanese nor typically American. This concept may be of considerable interest in both

developmental psychology and cross-cultural gender research.

Additionally, it suggests that limited exposure, as seen in the *randoseru* example, results in less stereotype formation. Efforts to improve gender equality in Japanese elementary school textbooks are thus a valid endeavor⁶.

Limitations: Quantitative, large-sample longitudinal studies are needed. However, this study used twins, thus controlling the rearing environment to some extent.

Concluding Remarks: Amidst diverse gender perspectives, each country and region must carefully examine how to achieve gender equality.

References

1. Wahlert, Lance, Gender, in *Bioethics: 4th Edition* Jennings, B (Ed), Macmillan Reference USA, 2014, pp. 1245-1248.
2. Murphy, Timothy, Gender identity, in *Bioethics: 4th Edition* Jennings, B (Ed), Macmillan Reference USA, 2014, pp.1248-1254.
3. Okanda, Mako, Meng, Xianwei, Kanakogi, Yasuhiro, et al. Gender stereotypes about intellectual ability in Japanese children. *Scientific Reports* 2022; 12: 16748.
4. Hidaka, Kyoko. “Separating by Color, Dividing by Color” 『色を分ける 色でわかる』 Kyoto University Press, Kyoto, 2021 pp.146-153. (in Japanese)
5. Hayashi, Masayo and Yamada, Ayaka. The History of the *Randoseru* (Elementary Schoolbag) and Gender in Japan: Focusing on the Transition

of its Colors. ランドセルの歴史と日本人のジェンダー観の関連に関する研究—ランドセルの色の変遷に着目して— Nanzan University Bulletin ‘Academia’ Humanities and Natural Sciences Edition 2022; 24: 183-203. 南山大学紀要『アカデミア』人文・自然科学編 第24号, 183—203, 2022年6月 (in Japanese with English abstract)

6. Kobayashi, Hiyori and Nagai, Akiko. Japanese Language Textbook as the Equipment of Gender Reproduction. ジェンダー再生産装置としての「国語教科書」社会福祉 (Social Welfare) 2023;64: 95-105. (in Japanese)

Table 1: Colors shown in coloring pictures.

	Female Participant	Male Participant
Coloring Girl’s Skirt	Red	Red
Hair Ribbon, Sock Ribbon	Red	Red
Coloring Boy’s Pants*	Red	Dark Brown
Coloring Girl’s <i>Randoseru</i> (School Backpack)	Black	Black
Coloring Girl’s Jacket	Yellow	Yellow
Coloring Boy’s <i>Randoseru</i> (School Backpack)	Black	Black
Coloring Boy’s Jacket	Yellow	Yellow
Non-gender Control (Snake, Large/Small)	Light Green, Yellow	Light Blue, Light Green

* Gender differences recognized.

Figure 1. Coloring by the female participant



Figure 2. Coloring by the male participant



Figure 3. Coloring by the female participant (Non-gender control)



Figure 4. Coloring by the male participant (Non-gender control)



Received 29 January 2026

Accepted 19 March 2026