Gender Predicts Performance on 6-year-olds' Knowledge of Place Value

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Purpose

Our purpose was to examine gender as a potential source of variation in children's understandings of place value.

Framework

Place value is a critical concept in mathematics. Given the importance of place value for success in later mathematics achievement, it is important to examine the factors that contribute to individual differences in place value knowledge, including one's gender.

Previous research has produced mixed findings regarding gender differences in mathematics. Although there is little evidence to support the idea that there are innate gender differences in math ability (Halpern et al., 2007), gender differences do arise on particular tasks. For example, studies have found females to show advantages in computation tasks, but males to show advantages on novel problem-solving tasks (Hornburg et al., 2017).

Methods

Participants: 71 children; 35 female (*M* age = 6.8 yrs; range 5.8 – 7.8 yrs)

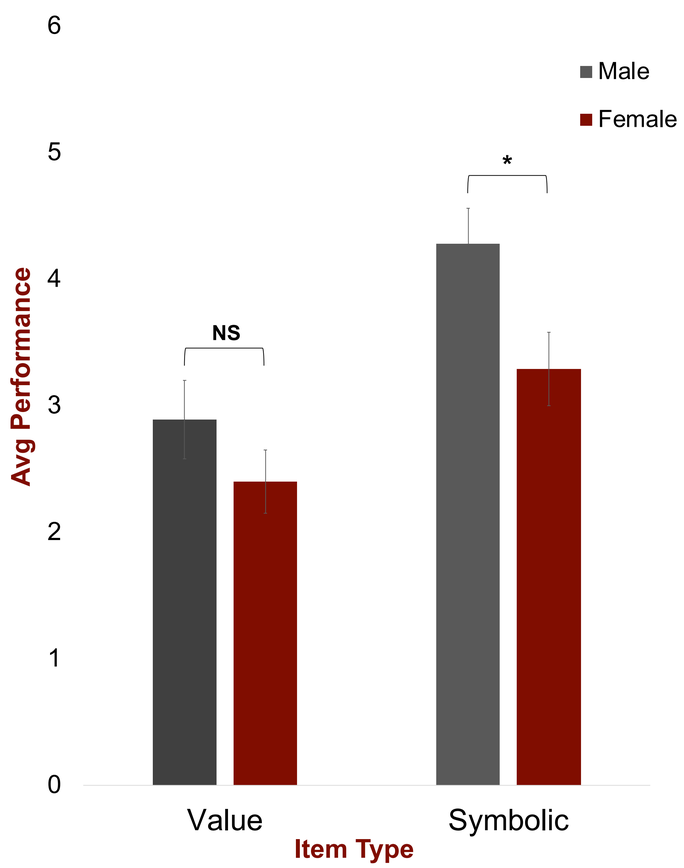
Task: Participants completed a 12-item, multiple choice assessment designed to measure their formal understanding of place value. The math assessment consisted of an equal number of two different item types: value and symbolic items.

Value v. Symbolic Items

Type	Measure	Example Assessment Questions
Value Items (n = 6)	Assessed children's knowledge of the quantity or magnitude of a digit within a multi-digit number	"What is the value of 3 in 732?" "Which set has the numbers in order from smallest to largest?" "Which number has a nine in the tens place and a two in the ones place?"
Symbolic Items (n = 6)	Assessed children's knowledge of the mapping between verbal and written forms of multi-digit numbers	"How is two hundred six written?" Which number could be between 548 and 596?" "Which is the same number as three hundred fifty?"

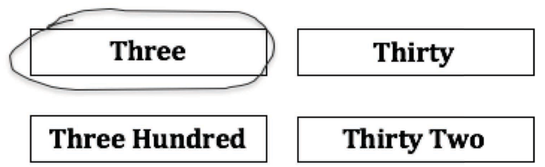
Results

Overall Performance

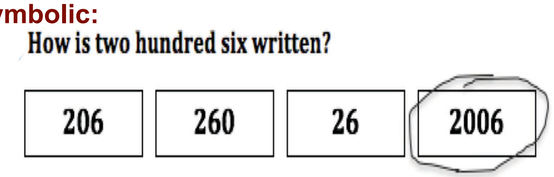


Sample Responses

Value:



Symbolic:



Regression Models of Predicting Value and Symbolic Scores

Variable	*β*	*t*	*p*
Predicting Value Scores			
Gender	-.115	-.998	.322
Age	.288	2.480	.016
Ethnicity	-.100	-.865	.390
Predicting Symbolic Scores			
Gender	-.241	-2.348	**.022**
Age	.474	4.585	.000
Ethnicity	.034	.331	.742

Note. Gender is dummy coded (female = 1, male = 0). Age is in years. Ethnicity is dummy coded (white = 1, non-white = 0).

Conclusions

Our results suggest that girls perform worse than boys when solving symbolic items, but not value items. Potentially, the symbolic items were more novel to these students, which is consistent with work suggesting girls show a disadvantage on math problems requiring novel strategies or insights (e.g., Gallagher et al., 2000).

Implications

These results contribute to a larger body of research regarding individual differences in mathematical understanding, indicating a need to further examine gender-based variations in performance.

References

- Gallagher, A. M., De Lisi, R., Holst, P. C., McGillicuddy-De Lisi, A. V., Morely, M., & Cahalan, C. (2000). Gender differences in advanced mathematical problem solving. Journal of Experimental Child Psychology, 75, 165–190.
- 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, 1–51.
- Hornburg, C. B., Rieber, M. L., & McNeil, N. M. (2017). An integrative data analysis of gender differences in children's understanding of mathematical equivalence. Journal of Experimental Child Psychology, 163, 140–150.