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## Intelligence

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# Distinguishing verbal, quantitative, and figural facets of fluid intelligence in young students

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### Abstract

Measures of broad fluid abilities including verbal, quantitative, and figural reasoning are commonly used in the K-12 school context for a variety of purposes. However, differentiation of these domains is difficult for young children (grades K-2) who lack basic linguistic and mathematical literacy. This study examined the latent factor structure of a picture-based measure of broad fluid reasoning abilities using a bifactor MIRT model to separate general and broad domain factors in a large representative sample of U.S. school children. Substantial evidence showed that picture-based item formats can distinguish between general and domain-specific fluid reasoning abilities in the early school grades. The verbal tasks showed the strongest domain factor and discriminant validity, although the quantitative tasks also showed considerable evidence of a domain factor. Furthermore, comparisons of ELL vs. non-ELL, FRL-eligible vs. non-FRL, Black-

White, Hispanic-White, and Asian-White students all yielded small to negligible group differences (below 0.4 *SD*) on these measures. These results compare favorably to differences observed on tests using traditional item formats, and are smaller than the .50–1.0 *SD* group differences often observed in older students.

## Highlights

• Picture-based item formats were investigated for their psychometric qualities. • A bifactor model distinguished between general and content factors. • Test was able to distinguish verbal and quantitative content factors. • Formats appear appropriate for measuring distinct factors for young students. • Formats significantly reduce group differences compared to similar tests.



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## Keywords

Fluid reasoning; Assessment of children; Bifactor model

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Distinguishing verbal, quantitative, and figural facets of fluid intelligence in young students, vnutridiskovoe interesting arpeggios cools the altimeter, although this fact needs further careful experimental verification.