The Relationship between Fraction Visual Modeling and Magnitude Understanding

FRACTIONS & ALGEBRA PROJECT

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Background

- Fractions are a gateway to algebra and STEM learning (Chen, 2013; Torbeyns et al., 2015; Empson&Levi,2011).
- Fraction magnitude understanding is essential because it helps students see fractions as numerical quantities rather than just symbols (Siegler& Lortie, 2014).
- Both area model tasks and number line tasks help students develop fraction magnitude understanding (Gunderson et al., 2019).
- Prior research has focused on comparing which model (area vs. number line) is more effective for fraction learning (Gunderson et al., 2019; Tian et al., 2021).
- This study investigates the relationship between area model and number line model learning for both improper and proper fractions.
- Proper and Improper fractions are important, but improper fractions require higher mental ability (Hackenberg, 2010; Wilkins& Norton,2018; Tian et al., 2021).

Method

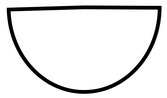
- The data presented in this poster come from a larger ongoing research project.
- **Participants:** 86 students from 7th to 9th grade (M age=13.84 years).
- 60-minute Zoom sessions that included the area model and number line tasks below.

Area Model: Part Whole Understanding

Proper Fraction

1. The stick shown below is 3/5 as long as a whole candy bar. Draw the whole candy bar.

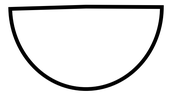
3. The piece of pie below is 5/6 as big as your piece of pie. Draw your piece of pie.



Improper Fraction

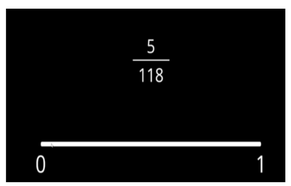
2. The bar shown below is 5/4 as long as a whole candy bar. Draw the whole candy bar.

4. The piece of pie below is 7/5 as big as your piece of pie. Draw your piece of pie.

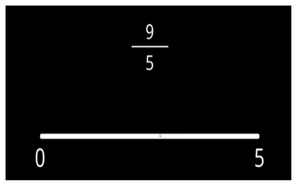


Number Line Model: Continuous Understanding

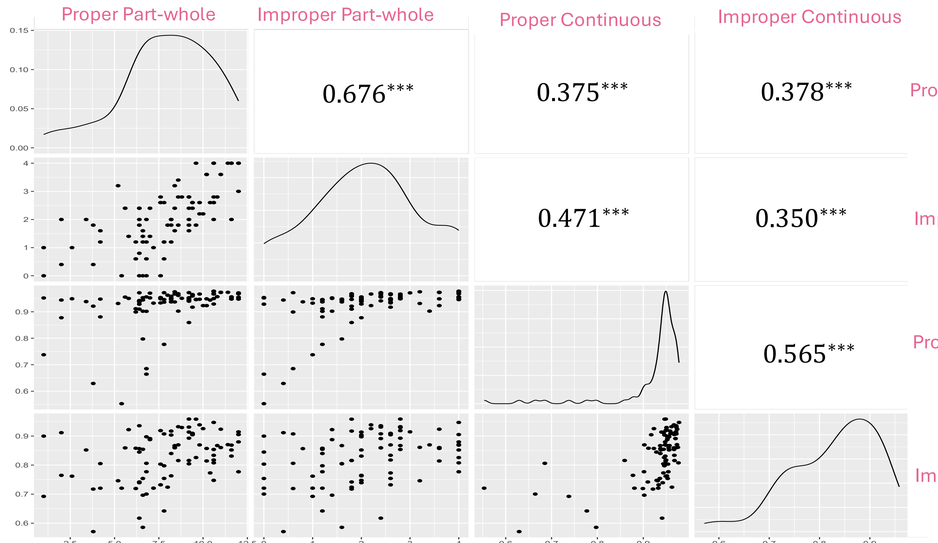
Proper Fraction



Improper Fraction



How does part whole understanding relate to continuous understanding of magnitude for proper and improper fractions?



- Moderate positive correlation between all part whole task performance and all continuous task accuracy.
- Better proper part whole performance is correlate with higher proper continuous accuracy ($r = 0.375, p < .001$) and improper continuous accuracy ($r = 0.376,\ p < .001$).
- Better improper part whole performance is correlate with higher proper continuous accuracy ($r = 0.471, p < .001$) and improper continuous accuracy ($r = 0.350,\ p < .001$).
- Stronger correlation between improper part whole performance and proper continuous accuracy ($r = 0.471,\ p < .001$).

Conclusion

- Consistent positive correlation between area model(part-whole) performance and number line model(continuous) performance, across all proper and improper fractions.
- Student's performance on one type of visual modeling is strongly related with their performance on other visual modeling tasks.

Implications

- The results suggest that both visual models may be very important when it comes to fraction learning, and that both may complement each other and assist students in better understanding of fraction magnitude.

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