

A Theoretical Model for the Design of Equal Sharing Problems

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Introduction

- Children's strategies for equal sharing problems
Four students want to share 10 brownies equally. How many brownies will each student get?
- Development of children's thinking → quotient interpretation of fraction (Charles & Nason, 2000; Empson et al., 2006)
- Relationship between problem features and children's strategies

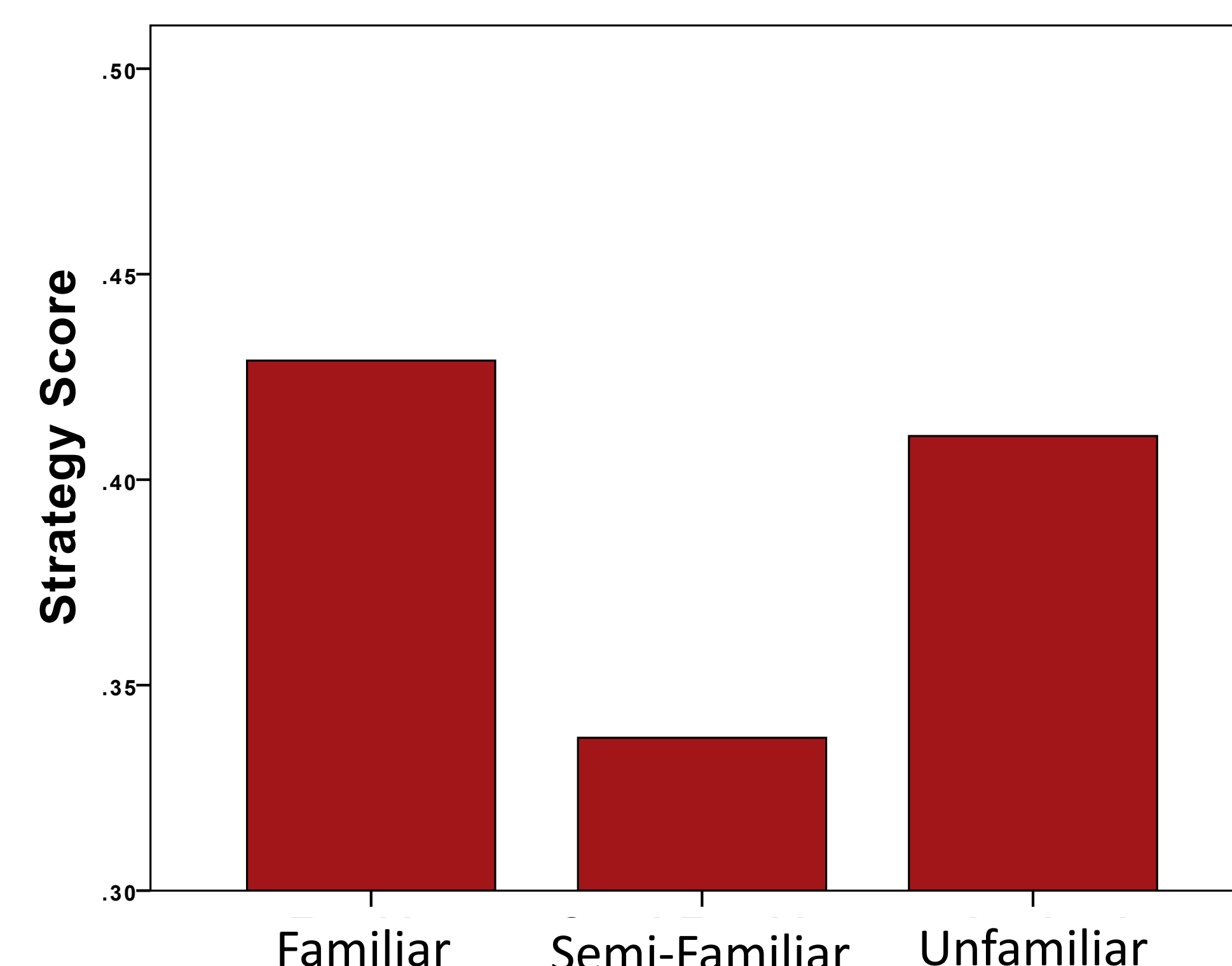
Objectives

- Use research data to construct a theoretical model for testing the features of the to-be-partitioned items on children's strategies

Background

Foster & Osana (2018)

Sample Problem	Problem Type
4 students want to share 10 brownies equally. How many brownies will each student get?	Familiar
8 people want to share 12 centimeters of string equally. How many centimeters of string will each person get?	Semi-familiar
8 people want to share 10 Porams equally. How many Porams will each person get?	Unfamiliar



Two Confounds

- Attribute (area/length): The semi-familiar problems involved partitioning length models, whereas all the familiar problems involved partitioning area models
- Unit type (standard/arbitrary): The semi-familiar problems involved standard units, whereas all the familiar problems involved arbitrary units
 - Children's partitioning strategies and reasoning about measurement vary across attributes and differ depending on the type of unit used (e.g., Boulton-Lewis et al., 1996; Curry et al., 2006; Hiebert & Tonnessen, 1976; Lehrer, Jenkins, & Osana, 1998)

Familiarity and "Groundedness"

- Familiarity depends on students' prior knowledge and experience (Mix et al., 2017)
- Grounded: Real-world referents (Goldstone & Son, 2005)
- Idealized: No direct reference to the physical objects they *could* represent (Koedinger et al., 2008)

Theoretical Model for Testing Features of Equal Sharing Problems

Familiarity	Groundedness	Unit of Measure	Attribute	
Student-dependent	Grounded		Area	Length
		Standard	A pan of brownies measures 10 cm ² . If Amanda wanted to share the pan of brownies equally among 4 people, how many square centimeters of brownie would each person get?	Four people want to share 10 cm of string equally. How many centimeters of string will each person get?
		Arbitrary	Amanda has 10 brownies and she wants to share them equally among 4 people. How many brownies will each person get?	Four people want to share 10 pieces of string equally. How much string will each person get?
	Idealized	Amanda has 10 porams and she wants to share them equally among 4 people. How many porams will each person get?		
		10 ÷ 4 = □		

Conclusion

- Identifying the types of equal sharing problems that optimize the development of students' problem-solving strategies and fractions knowledge is informative in the design and implementation of classroom instruction.