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Exploratory Learning Using Consistency Problems: Activity Type Matters

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EXPLORATORY LEARNING

Exploring a novel problem prior to receiving instruction has been found to improve conceptual understanding (Schwartz & Bransford, 1998; Loibl et al., 2016; Kapur, 2016; Weaver, Chastain; DeCaro, DeCaro, 2018).

Exploration helps students activate prior knowledge, increase perceived knowledge gaps, and recognize problem features (Loibl et al., 2016).

However, exploratory learning does not always lead to learning benefits (e.g., Chase & Klahr, 2017; Fyfe, DeCaro, & Rittle-Johnson, 2014).

In addition, many prior studies have not used controlled experimental designs to examine the benefits of exploratory learning (see Hsu et al., 2015, Loibl et al., 2016; Schwartz et al., 2011).

RESEARCH QUESTION

Does the type of activity impact whether exploration before instruction benefits learning?

METHODS

Participants Undergraduate students completed experiment during their *Introduction to Psychology* course ($N = 197$, IFRD $n = 45$, IFCC $n = 50$, EFCC $n = 51$, EFRD $n = 51$).

Procedure

Worked on packet to learn about standard deviation.

Phase	Instruct-First Condition	Explore-First Condition
1	Instruction	Consistency Problem
2	Consistency Problem	Instruction
3	Posttest	Posttest

Activity Type: Format of consistency problem manipulated between conditions.

Rich Dataset

The managers agreed they should buy the tea with the most consistent levels of antioxidants from year to year. They decided to approach this decision mathematically, and want a formula for calculating the consistency of antioxidant levels for each tea grower. This formula should apply to all tea growers and help provide a fair comparison. The managers decided to get your help.

Year	Tea growers		
	Thourbo (Antioxidants per mg)	Dareen	Ging
2010	--	14	11
2011	10	19	12
2012	16	14	14
2013	16	17	21
2014	20	17	18
2015	13	9	14

Come up with a formula for consistency to show which tea grower has the most consistent levels of antioxidants. Show your proposed formulas and calculations on the next page. You may also list steps for how you would calculate consistency. Circle the tea grower that you decide is most consistent (You may use the next page to show your work).

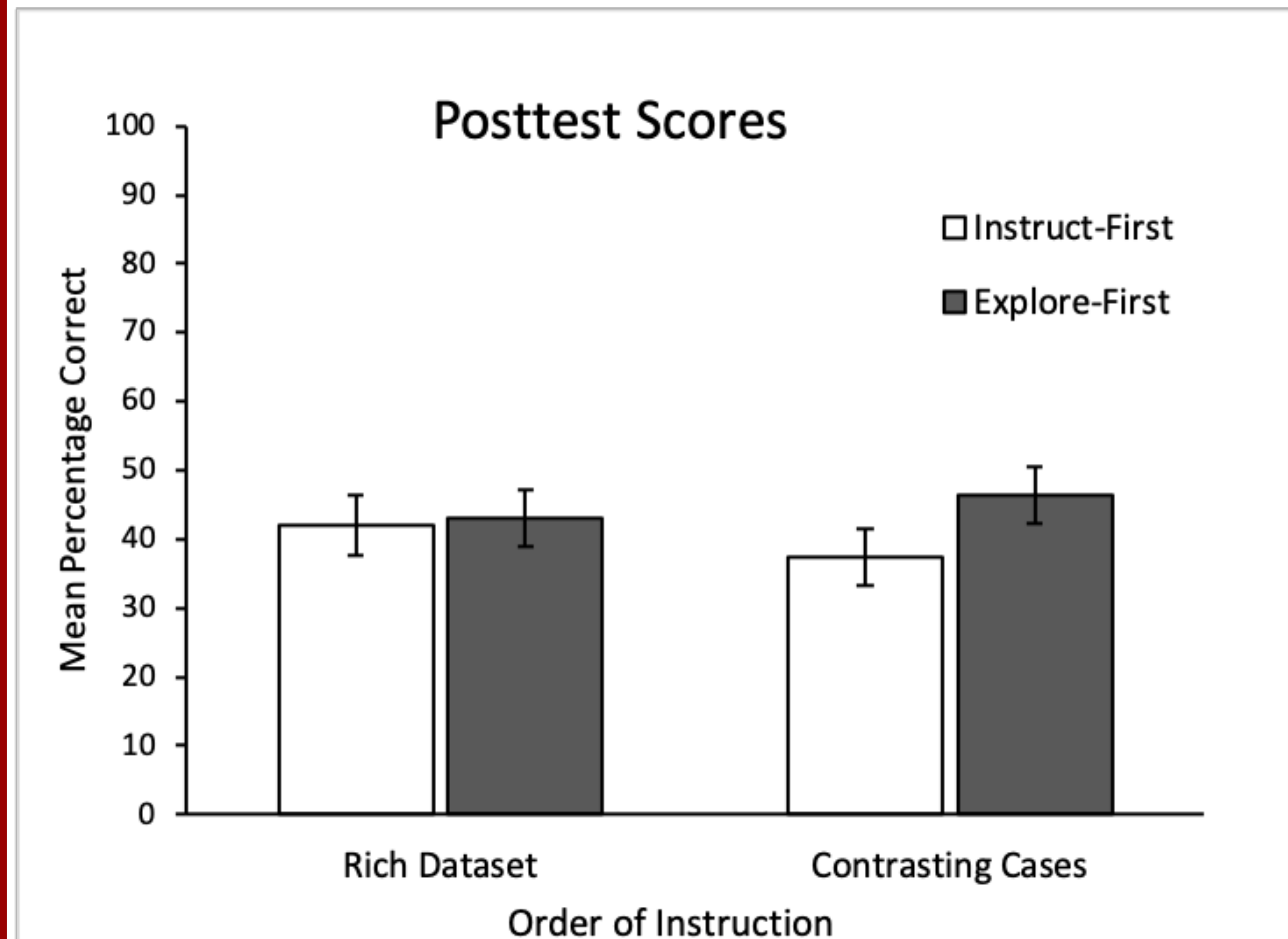
Contrasting Cases

The managers agreed they should buy the tea with the most consistent levels of antioxidants from year to year. They decided to approach this decision mathematically, and want a formula for calculating the consistency of antioxidant levels for each tea grower. This formula should apply to all tea growers and help provide a fair comparison. The managers decided to get your help.

Year	Tea growers		
	Thourbo (Antioxidants per mg)	Dareen	Ging
2013	--	14	9
2014	--	15	13
2015	15	15	14
2016	14	15	21
2017	16	16	19
2018	15	15	14

Come up with a formula for consistency to show which tea grower has the most consistent levels of antioxidants. Show your proposed formulas and calculations on the next page. You may also list steps for how you would calculate consistency. Circle the tea grower that you decide is most consistent (You may use the next page to show your work).

RESULTS



CONCLUSION

Activity type mattered. Exploratory learning did improve scores when the activity used contrasting cases but did not improve posttest scores when the activity included a rich dataset.

Contrasting cases may help students discern important problem features (e.g., mean, N, consistency among scores in one column compared to another column).

Currently conducting further research on exploratory learning and recruiting more participants to this study.

By presenting exploratory activities before learning, these results help us better understand both when and why exploratory learning improves understanding.