

Early Numeracy Intervention

Evaluating the Efficacy of a First Grade Math Tutoring Program in a Montessori Context

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INTRODUCTION

Students who struggle with early numeracy skills are at risk for later challenges when learning math. Research shows early numeracy skills (e.g., number identification, understanding quantity, counting, and number sequencing) are strong predictors of future math success (Bryant et al., 2008).

Early Numeracy Intervention (ENI; Bryant et al., 2011) is a supplemental math program that targets early numeracy skills. It was developed from Jordan and colleagues' (2003; 2006) research on early numeracy growth in kindergarten and first grade. After 19 weeks of intervention, Bryant and colleagues (2011) showed that students at-risk for math delays improved number sequencing skills and place value knowledge, as well as overall math achievement.

Although limited research exists on the effectiveness of ENI in alternative school settings, it is described as easily adjusted to different educational settings. This study evaluates ENI's effectiveness as a supplemental math intervention program in a Montessori setting.

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METHODOLOGY

PARTICIPANTS AND SETTING

Intervention took place at a Montessori elementary. Montessori education offers hands-on learning at one's own pace.

Participants were two 1st graders from different cross-age classrooms of 1st-3rd graders. They were identified by school screenings and teacher nomination as at-risk in math.

ENI was delivered to a group of 5 students in a cafeteria. Another group met in the cafeteria at the same time. ENI was the students' last activity of the day.

DEPENDENT VARIABLES

Place Value (PV): Assesses ability to write numbers represented in base-10 blocks and select the correct grouping of base-10 blocks to represent a number. The task is timed.

Number Identification (NID): Assesses the ability to correctly read single digit to triple digit numbers. The task is timed.

VALIDITY MEASURES

Trained researchers evaluated interobserver agreement and procedural integrity for assessments and intervention delivery.

Interobserver Agreement: 100% for all assessments.

Intervention Integrity: Individual integrity checklists were created specific for each lesson to develop accuracy of stages of modeling

PROCEDURE

Trained university students delivered 45-min. lessons, 3 times/week, for 13 weeks. This included ENI Units 1-5. Sessions typically included a warm up activity and two lessons. Lessons incorporated interventionist modeling of a skill, guided practice with corrective feedback, and independent practice. A lead interventionist and 1-2 support interventionists were present each day. Progress monitoring occurred after lessons.

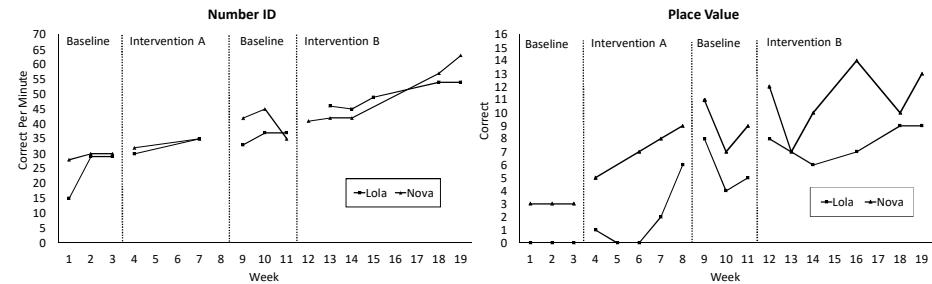
Baseline: No intervention was provided. Typical math instruction in the Montessori classroom continued.

Intervention A: Five weeks consisting of lessons addressing ordering and comparing numbers, single digit addition and subtraction and word problems.

Intervention B: Eight weeks consisting of lessons addressing single digit addition and subtraction, ordering and comparing numbers, relationships of ten, and word problems.

EXPERIMENTAL DESIGN

A single case ABAB design (Kennedy, 2005) examined the effects of participation in ENI on early numeracy skills for both students.



Mean Scores by Phase

Condition	Number ID (Number Correct Per Minute)				Place Value (Number Correct)			
	Baseline	Intervention A	Baseline	Intervention B	Baseline	Intervention A	Baseline	Intervention B
Lola	24.3	32.5	35.7	49.6	0	1.8	6	7.3
Nova	29.3	33.5	40.7	49	3	7.3	9	11

RESULTS

NOVA

NID: There was a minimal change in level from baseline to Intervention A and a neutral trend in both. An upward trend in the baseline confounds interpretation. Upon return to baseline, level of performance increased rather than decreased, but did show a negative trend. There was a higher level and positive trend in performance in Intervention B.

PV: There was a clear change in level and trend from baseline to Intervention A and again in the reversal to baseline. Performance in Intervention B was more variable, but showed a change in level and trend relative to baseline. In both intervention conditions a positive moderate trend was evident.

DISCUSSION / IMPLICATIONS

Results offer beginning support for the use of ENI as a supplemental math intervention with students in a Montessori setting.

- ❖ The intervention was able to be delivered with fidelity in the Montessori setting, as fidelity checks showed 100% accuracy.
- ❖ Clear effects of the intervention on place value, or base-10, skills were evident for both participants. Applications with base-10 was one instructional target of ENI, particularly during Intervention B.
- ❖ Participants also showed positive gains in Number Identification skills over the course of the intervention. This is noteworthy, because the intervention did not directly practice reading numbers.

LOLA

NID: There was a change in level from baseline to Intervention A; however, both showed a moderate positive trend confounding interpretation. Further, performance did not decrease in the second baseline. There was a clear change in level and trend in Intervention B.

PV: There was a clear change in level and, though not immediate, a change in trend from baseline to Intervention A. There was also an expected change in level and trend in reversal. Reapplication of the intervention showed a change in level and trend. Both intervention phases had a positive moderate trend.

LIMITATIONS

- ❖ Weekly progress monitoring with Number Identification did not occur during the first intervention condition due to school vacation days. Therefore, a causal relationship between ENI participation and NID gains cannot be determined. Outside factors may explain participant growth.
- ❖ The dependent variables for this study did not address all skills targeted by ENI. Future research is needed to explore additional early numeracy outcomes when ENI is used in a Montessori setting.
- ❖ Intervention acceptability data for teacher's was not collected. While outcomes are promising, factors including feasibility of implementation by teachers and beliefs that the intervention is effective may play a role in teacher adoption of the program.