Using Brief Experimental Analysis (BEA) to Identify Effective Math Interventions

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Project Overview

In 2009, the National Assessment of Educational Progress reported that the steady climb of fourth-grade mathematic achievement across the country had suddenly reversed. Only 39% of the nation's fourth graders were rated proficient in math. The purpose of this study was to identify math computation fluency interventions for three low achieving elementary school students using Brief Experimental Analysis (BEA) methodology. BEA has been used primarily to identify individualized oral reading fluency interventions with little empirical research validating the procedure for math computation. The application of BEA to academic problems can provide a direct link between assessment and intervention. The current study involved two related experiments. Experiment 1 empirically evaluated several interventions to determine which produced the greatest increase in Digits Correct Per Minute over baseline. Experiment 2 investigated the effects of the empirically-selected interventions on the math computation fluency over two months. Results suggest that BEA of math computation fluency can empirically select interventions that improve math computation skill over time.

Method

Participants. Three elementary aged children receiving after school services participated in this project. All participants were 8 year old females. Participants were referred by teachers because of poor math computation performance.

Dependent Variable. Digits Correct Per Minute (DCPM). Interrater reliability was calculated for 100% of sessions and was 100%.

Conditions. Interventions were modified using examples from Carson & Eckert (2003) and Codding (2009).

- *Baseline (BSL)*
  - *Students completed math computation problems over one minute without intervention.*
- *Timed Sprint (TS)*
  - *Two 30 second intervals of testing with a one minute break in between intervals.*
- *Contingent Reinforcement (CR)*
  - *Higher preferred rewards were earned when participant met a goal of 25% higher than average baseline and earned lower preferred reward when participant met 15% higher than average baseline. Participants were tested for one minute.*
- *Cover-Copy-Compare (CCC)*
  - *Participants completed a CCC worksheet that utilized vocal and motor repetition before being tested for one minute.*
- *Timed Sprint & Contingent Reinforcement (TS+CR)*
  - *Intervention combined TS & CR aspects.*
- *Timed Sprint & Copy-Cover-Compare (TS+CCC)*
  - *Intervention combined TS & CCC aspects.*
- *Contingent Reinforcement & Cover-Copy-Compare (CR+CCC)*
  - *Intervention combined CR & CCC aspects*
- *Timed Sprint & Contingent Reinforcement & Cover-Copy-Compare (TS+CR+CCC)*
  - *Intervention combined TS & CR & CCC aspects.*

Experiment 1 (BEA). Interventionists introduced each participant to each condition (i.e., intervention) for both addition and subtraction. The condition that produced the greatest increase of DCPM over baseline was selected for Experiment 2. If there were multiple high scoring interventions, those were then retested to determine most effective condition.

Experiment 2 (Treatment). Highest scoring intervention was used as each participant's selected intervention. Following baseline, an alternating treatment design was used.

Procedural Integrity. Sessions were video taped and reviewed for 100% of the sessions. Integrity was calculated to be 100%.

Designs

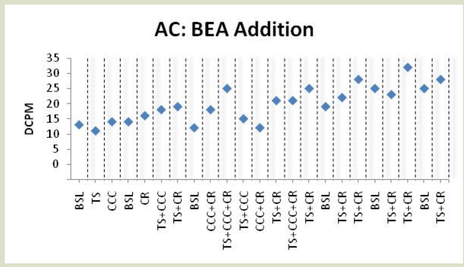

Figure 1. BEA demonstrating TS+CR was effective for addition.

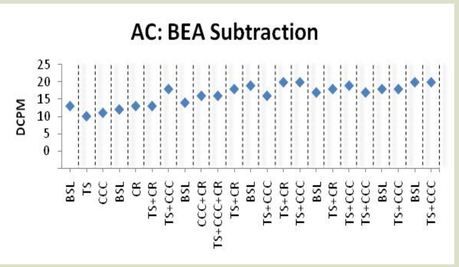

Figure 2. BEA demonstrating was effective for TS+CCC subtraction.

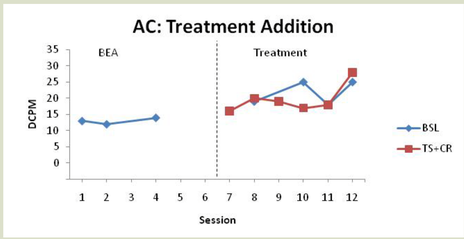

Figure 3. Treatment showing TS+CR was effective for treatment.

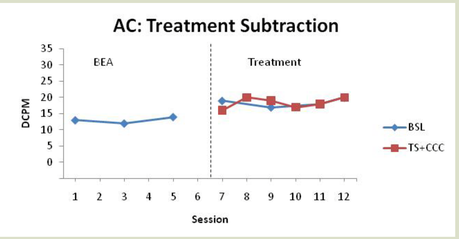

Figure 4. Treatment showing TS+CCC was effective for treatment.

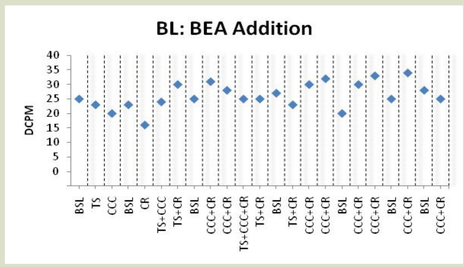

Figure 5. BEA demonstrating CCC+CR was effective for addition.

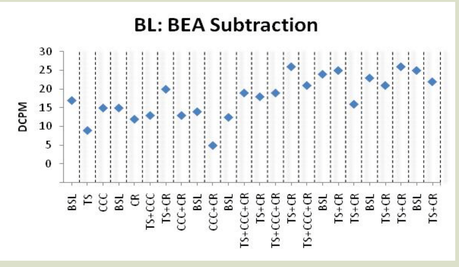

Figure 6. BEA demonstrating was effective for TS+CR subtraction.

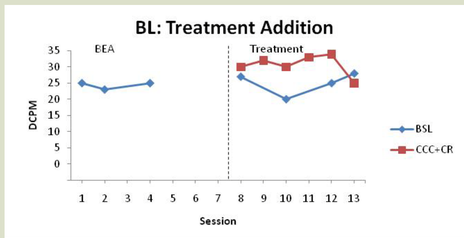

Figure 7. Treatment showing CCC+CR was effective for treatment.

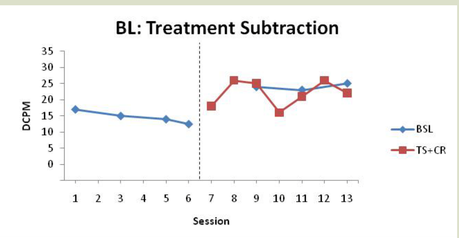

Figure 8. Treatment showing TS+CR was effective for treatment.

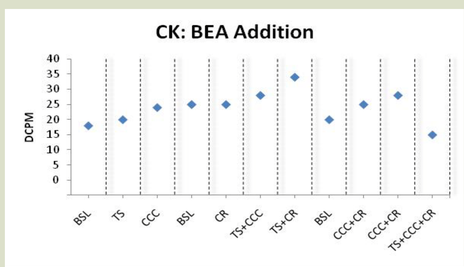

Figure 9. BEA demonstrating TS+CR was effective for addition.

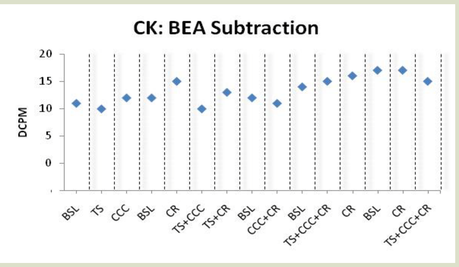

Figure 10. BEA demonstrating was effective for CR subtraction.

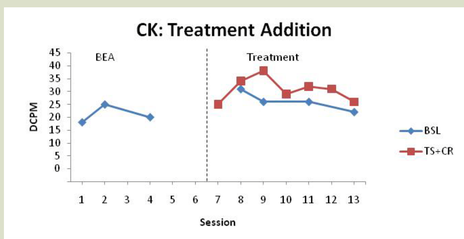

Figure 11. Treatment showing TS+CR was effective for treatment.

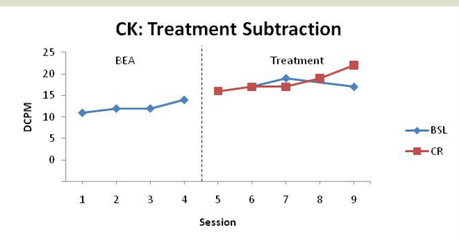

Figure 12. Treatment showing CR was effective for treatment.

Discussion

BEA was able to empirically select math computation interventions for addition and subtraction. Each participant did not have the same intervention selected for addition that they had selected for subtraction. Considering Experiment 2, our findings suggest that BEA can be effective in increasing math fluency in addition and subtraction.

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