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THE EFFECTS OF COVER, COPY, AND COMPARE WITH FREE TIME IN MATH FOR ELEMENTARY STUDENTS WITH SEVERE BEHAVIOR DISORDERS*

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ABSTRACT

The purpose of this study was to evaluate the effectiveness of cover, copy, compare (CCC) for math with three students with severe behavior disorders. The participants were a 12-year-old and two 10-year-old boys. The first participant was in the sixth grade while participants 2 and 3 were attending the fourth grade. Participant 1 did not have a specific diagnosis; but all previous assessments indicated he was learning disabilities in the areas of reading and mathematics with a behavioral component. Participants 2 and 3 were both diagnosed with severe behavior disorders not otherwise specified. Students earned five minutes of free time for each session they participated. A multiple baseline design across participants was implemented to evaluate the effectiveness of CCC. Corrects and errors were recorded for three mathematical concepts that included writing the fraction of a shaded area, as well as adding and subtracting fractions with the same denominator. Each participant increased correct responses and decreases in errors during CCC. The educational staff was pleased at the progress each of the participants was able to make while practicing the skills independently. The intervention was practical and easy to implement in a self-contained special education classroom setting.

Keywords: behavior disorders, elementary school students, single case research, math performance, cover, copy, and compare

INTRODUCTION

Math is an important aspect to life. One can observe that math concepts or ideas a such as a road divided into two lanes, buildings which are multiple stories in height, and necessary amounts of an ingredient to make a favorite family recipe (ref). Every job requires math in some form or another whether it be in computation or calculation.

Many students struggle to understand concepts relating to fractions (Tanner, 2008). It is thought that students who struggle in the conceptual ideas of fractions also struggle in the basic principles of algebra. An analysis of the National Assessment of Educational Progress (NAEP) for 1990 showed

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that 46% of high school graduates were competent in the areas of decimals, percentages, fractions, and basic algebra (Brown & Quinn, 2007). The difficulty of fractions comes from the necessity of students in the notions of part-to-whole, whole-to-part, and whole-to-whole relations. These three areas are also known as part-whole, ratio, operator, quotient, and measure. The five sub-constructs can be broken into the areas of operations of fractions, fraction equivalence, and problem solving (Charalambous & Pitta-Pantazi, 2007). The various concepts of fractions are key to every aspect of daily life.

Several data based interventions have been developed to teach math skills to students with disabilities. One well-documented intervention has been cover, copy, and compare (CCC). This particular intervention reduces the necessity for one-on-one instruction with an adult or peer (McLaughlin & Skinner, 1996). It has also been shown to be effective in increasing performance across many academic areas, including mathematics (Cates, Dunne, Erkfritz, Kivisto, Lee, & Wierzbicki, 2006). CCC is a self-managed self-tutoring strategy. It can he used in any academic area that requires a discrete response (McLaughlin & Skinner, 1996). CCC can require a written response such as solving a basic math facts (Skinner, McLaughlin, & Logan, 1997) or an oral response (Kaufman, McLaughlin, Derby, & Waco, 2011). If the student makes an error, they are required to correct their error three times before moving on to the next problem. If the student is orally answering his math problems, he has to restate the problem and answer correctly three times before moving to the next problem (McLaughlin & Skinner, 1996).

The use of CCC is inexpensive, and it's easy to implement. This particular intervention allows students to self-monitor and self-tutor (McLaughlin & Skinner, 1996; Neis & Belfiore, 2006; Skinner, McLaughlin, & Logan, 1997). CCC interventions can be employed in multiple settings including resource rooms (McLaughlin, Mabee, Reiter, & Byram, 1991), self-contained special education or and general education classrooms (Hubbert, Weber, & McLaughlin, 2000; Cieslar, McLaughlin, & Derby, 2008). Not only is CCC effective across classroom settings, it is also effective across a range of students including typically developing (Schermerhorn & McLaughlin, 1996) to students with wide range of disabilities (Cieslar et al., 2008; McLaughlin et al., 1991; Pratt-Struthers, Bartalamay, Williams, & McLaughlin, 1989; Skinner, Belfiore, & Pierce, 1992; Skinner, Turco, Beatty, & Rasavage, 1989; Smith, Dittmer, & Skinner, 2002). Finally, CCC has been employed multiple school settings which include elementary (Hubbert et al., 2000), middle (McLaughlin et al., 1991), high school (Ciesler et al., 2008). In addition it has been implemented in the home (Stading, Williams, & McLaughlin, 1996; Stone, McLaughlin, & Weber, 2002).

Free time has been employed as a consequence in the classroom (Alberto & Troutman, 2008; Osborne, 1969; Serna & Osborne, 1993). Free time has been employed with both social (Higgins, Williams, & McLaughlin, 2003) as well as academic responding (Serna & Osborne, 1993). In may classroom research, increased accuracy or decreased errors led to the awarding of free-time to students. Free time has been used to improve student academic performance in reading (Stewart & McLaughlin, 1986), math (Johnson & McLaughlin, 1982), handwriting, (Hopkins, Schutte, & Garton, 1969), or spelling (McLaughlin et al., 1991). Free time has been implemented in a wide range of classroom settings and with a diverse range of student groups (Alberto & Troutman, 2008).

The purpose of the present research was to employ CCC with three students with severe behavior disorders. The second was to evaluate CCC with three different math skills. The final purpose was to extend and replicate the large amount of evidence supporting the use of CCC for students with severe behavioral issues.

METHOD

Participants and Setting

There were three participants in this study. Each of the participants was diagnosed with a behavioral disorder. This study focused on mathematics for each of the participants. The first participant was a 12-year-old, sixth grade boy, with difficulties in the academic areas of reading, writing, and

mathematics. This student rarely exhibited his behaviors, but they included swearing, throwing objects, physical contact with others (i.e. hitting), and talk-outs. The second participant was a 10-year-old, fourth grade boy, who was only behind academically in the area of mathematics. This student often disrupted class through swearing, talk-outs, and throwing of items such as pencils, assignments, and occasionally chairs. The third participant was a 10-year-old, fourth grade boy, who was below grade level in all academic areas. The only behavior this student exhibited was elopement. He often ran away from teachers and instructional assistants when he viewed a task as either boring or too difficult. Each of the participants was excited to assist the first author with a research project.

The study took place at a table located within the self-contained behavioral intervention classroom. The time of day varied daily as the schedule for lessons varied; however, the participants were willing to accommodate the schedule as necessary. During this time, students between the ages of second and sixth grade were present. Multiple lessons were taught simultaneously. The participants worked at one of two tables in the classroom where other students could observe what was happening. The first author was required to ask the other students and instructors to remain away from the work area so that the participants could maintain their concentration, and so that they received no additional assistance except from the first author.

MATERIALS

The materials needed in this study were multiple copies of each of the following: worksheets – baseline worksheet, writing the fraction of a shaded area given a model, adding fractions with the same denominator, addition fraction test, subtracting fractions with the same denominator, and subtraction fraction test (See Tables 1-6). Each participant also required a pencil, which was provided within the classroom. A data collection sheet for each participant (See Table 7-9) was used to record the results of each session.

Dependent Variables and Measurement

The dependent variable for the participants was the number of correct math problem from three different written worksheets. This included writing the fraction of a shaded area, as well as adding and subtracting fractions with the same denominator. Which problems to teach were determined by three pretests of 12 problems each containing writing the fraction of a shaded area given a model (4 problems), adding with the same denominator (4 problems), and subtracting with the same denominator (4 problems). The problems were divided into three sets. Set 1 contained ten models of shaded areas in which the participants were prompted to copy the model, write the fraction of the shaded area, then compare the answers. Fractions the students were asked to write included 1/2, 3/7, 6/9, 11/13, 2/3, 2/10, 6/8, 2/4, 3/5, and 1/3. Set 2 contained ten equations in which students were asked to find the sum of fractions with the same denominator. Set 3 contained ten equations in which the participants were asked to find the difference of fractions with the same denominator. The process for Sets 2 and 3 were the same as for Set 1. Students were given no time limit in which to complete the problems.

Data Collection and Interobserver Agreement

Data were collected daily for each of the participants. Interobserver reliability was taken for each participant, approximately every three sessions. Reliability as to the dependent variable were gathered by either an instructional assistant, or an acquaintance of the researcher. At the end of each session for reliability, each individual scorer tallied the number of correct responses on the CCC worksheets. The interobserver agreement for each of the participants was 100%. This percentage was found by dividing the number correct over the over-all possible and then multiplying by 100. Interobserver agreement was taken 25% of the time for each of the participants.

Experimental Design and Conditions

A combination AB and multiple baseline design (Kazdin, 2010) across problem sets was employed. This was done to examine effectiveness of the CCC intervention for each skill or problem set. A three

day baseline for Participant 1 in the areas of writing the fraction of a shaded area and adding fractions with the same denominator. Baseline lasted for 10 sessions for the third area of intervention for Participant 1. Participant 2 immediately began intervention on the second set of data after three consecutive days of baseline. This was due to mastery of the first set of data within the baseline testing. Participant 2 completed seven sessions of baseline before beginning intervention in Set 3. Participant 3 created three sessions of baseline prior to intervention for Set 1, ten sessions before intervention in Set 2, and intervention was not start for Set 3. Each session ran for 15 to 20 minutes.

Baseline. During baseline, each participant was given a worksheet containing 12 problems. There were four problems of each of the following types – writing the fraction of a shaded area, adding fractions with the same denominator, and subtracting fractions with the same denominator. Upon completion of one set, participants would begin intervention in the next set. However, prior to the mastery of a set, students were in baseline. Participant 1 remained in baseline for three sessions for each Set 1 and 2, and ten session for Set 3. Participant 2 mastered Set 1 during baseline, so no intervention was implemented. Baseline lasted three sessions for Set 2 and 7 sessions for Set 3. Participant 3 began intervention on Set 1 after three sessions, intervention on Set 2 after ten sessions, and no intervention began on Set 3.

CCC. After baseline, the CCC was implemented. It was administered in a staggered fashion across sets. During CCC, a model was given which the participant was asked to copy. Students then cover the written sample, and write the problem or word again without looking. Finally, participants compare their problem with the model problem. If a problem is incorrect, the student is then given an error drill to rewrite the problem three times. Praise was given to each of the participants as a way of encouraging their work. Also each participant earned free time for completing the tasks with 80% accuracy or higher. This process was continued daily for each of the sets.

RESULTS

Participant 1

The number of problems answered correctly during baseline and intervention can be seen in Figure 1. During Set 1, the participant averaged one and a third errors during baseline. Throughout intervention, the student averaged eight-tenths of an error. Throughout the CCC intervention, the participant increased in percent correct from 3.67 to 9.2 (range 3-10). The error rate decreased from 1.33 to .8 (range 0-3 errors). During Set 2, the participant averaged 100% correct during baseline. Intervention was implemented for Set 2 as the participant often rushes and relies on fingers for counting. Throughout CCC, the participant increased in percent correct from all four problems correct during baseline to 14.5 problems correct (range 4-20). He also increased his error rate from zero to .58 during CCC (range 0-2). During Set 3, the participant averaged 1.2 errors during baseline, and he averaged 4 corrects in baseline. While in intervention, the participant increased problems correct to 18.6 (range 16-20). His error rate in intervention increased to 1.4 (range 1-4).

Participant 2

The number of problems answered correctly in baseline and intervention can be seen in Figure 2. During Set 1, the participant averaged 100% correct during baseline. No intervention was given for this set. During Set 2, the participant averaged 0 correct in baseline conditions. During the CCC intervention, the participant increased the correct rate to 17.25 (range 7-20). He decreased the error rate to .58 (range 0-2). During Set 3, the participant averaged 2.42 correct and 2 errors during baseline conditions. The participant increased the rate correct to 15.3 (range 7-20) during intervention. The participant decreased the error rate to 1 (range 0-4) during CCC.

Participant 3

The number of problems answered correctly in baseline and intervention can be seen in Figure 3. During Set 1, the participant averaged 0 correct during baseline. During the CCC intervention, the participant increased the correct rate to 9 (range 7-10). He decreased the error rate to 1 during

intervention (range 0-3). During Set 2, the participant averaged 8.5 correct during baseline. With intervention, the participant increased the correct rate to 19.2 (range 18-20). The participant decreased the error rate to .8 (range 0-2). During Set 3, the participant averaged 10.33 correct. CCC was not used with this set because Participant 3 showed an increasing trend for problems correct over the span of baseline conditions and no intervention was warranted.

DISCUSSION

The results indicated that using CCC was effective. All three participants increased their correct responses while simultaneously decreasing the number of errors. Each participant increased their accuracy with certain fractions. However, each participant also generalized the skills taught to the classroom curriculum in daily exercises involving fractions of shaded areas or adding and subtracting with the same denominator. As the study continued, the participants' willingness to participate increased as the students realized that completion of the task led to free time. This incentive seemed to work well for all three participants. Overall, this intervention was effective.

Each participant was also able to implement the skills taught within the study to the general classroom. In fact, our participants began assisting other students in the areas of writing fractions of a shaded area or adding and subtracting fractions with the same denominator. Each of the participants was willing to work with another adult new to the classroom environment. Lastly, the study replicated other mathematical studies using CCC to teach given concepts. By replicating other studies, this validates the outcome of these participants and the effectiveness of CCC in mathematics.

The outcomes provide additional evidence as to the efficacy of CCC with an additional group of students. We also replicated the prior work of our own research group (i.e. Carter et al., 2011) as well as that of Skinner and his colleagues (Cates et al., 2006; Skinner et al., 1989, 1991, 1992; Smith et al., 2002).

The present research had booth strengths and limitations. Some of the strengths include the low cost of materials, ease of implementation, more than one participant was evaluated, multiple data points evaluating the effectiveness of CCC. In addition, when Participant 1 mastered his facts in the first baseline, we were able to move to Set 2. Some of the weaknesses include not having a set scheduled time of day to work with our participants. The first author had to employ a separate location to complete the study in a quiet environment. Another weakness of this study was the small number of days the intervention was employed. Each participant only had between 12 to 15 total sessions. Clearly a longer analysis is needed. The role of free time as part of the CCC intervention was not evaluated. The use of additional CCC conditions with and without free time could determine its impact. Finally, each participant showed increases in math performance during baseline in either Sets 2 or 3. This finding deserves additional study. It could have been generalization from learning the problems Set 1, or the problem types were similar in both sets. These outcomes appear to warrant further study.

In summary, the use of CCC with students with severe behavior disorders needs further analysis. Our previous work with a single participant (Bishop, McLaughlin, & Derby, 2011) also found variable performance when employing and evaluating CCC at classroom or in a summer program.

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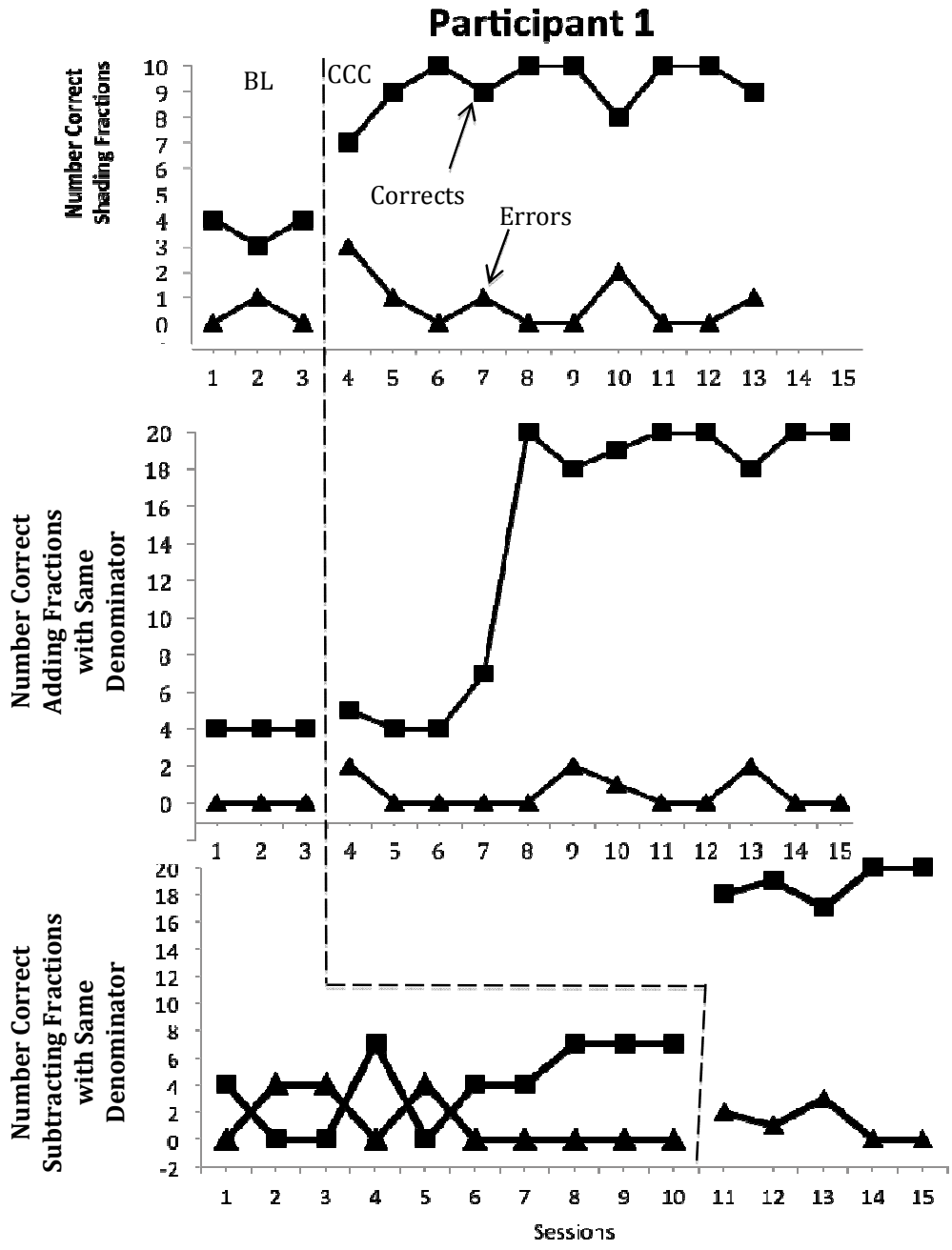

Figure 1. Number of corrects and errors for Participant 1 during baseline and CCC.

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Participant 2

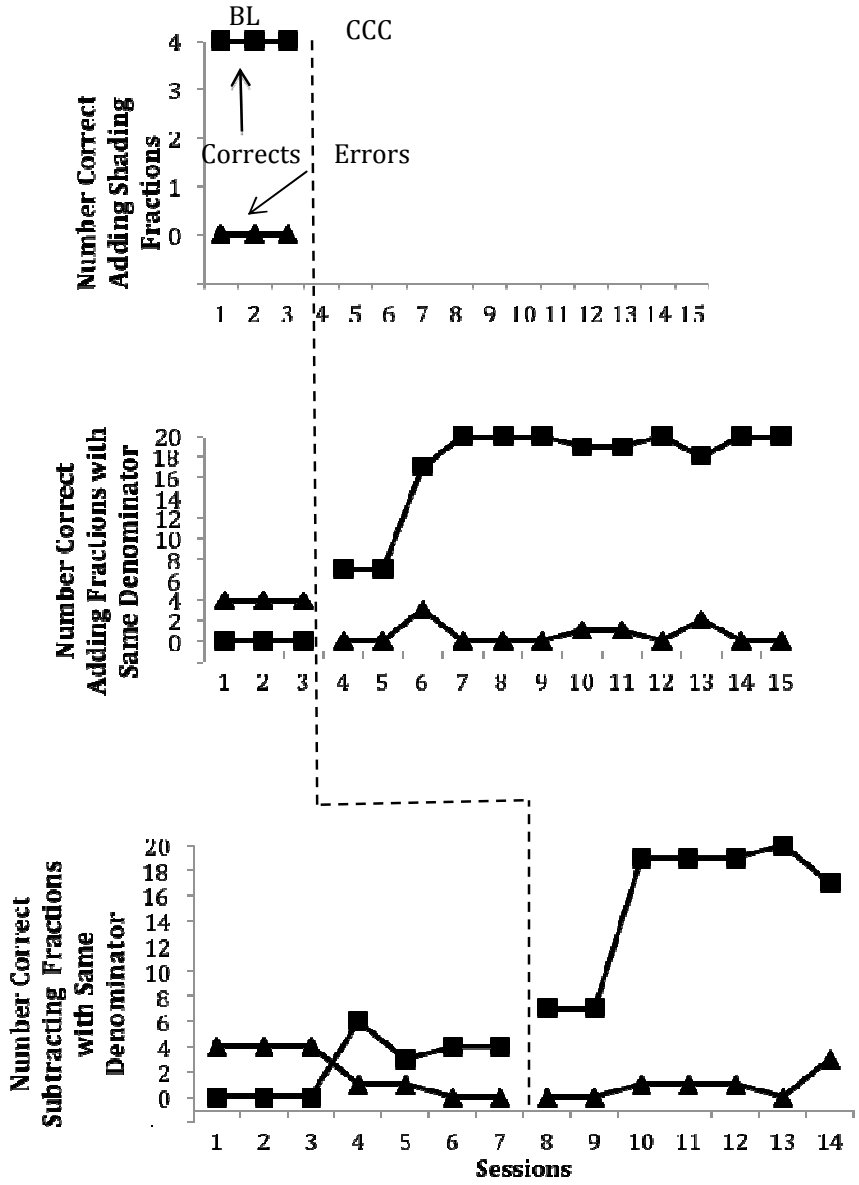

Figure 2. Number of corrects and errors for Participant 2 during baseline and CCC.

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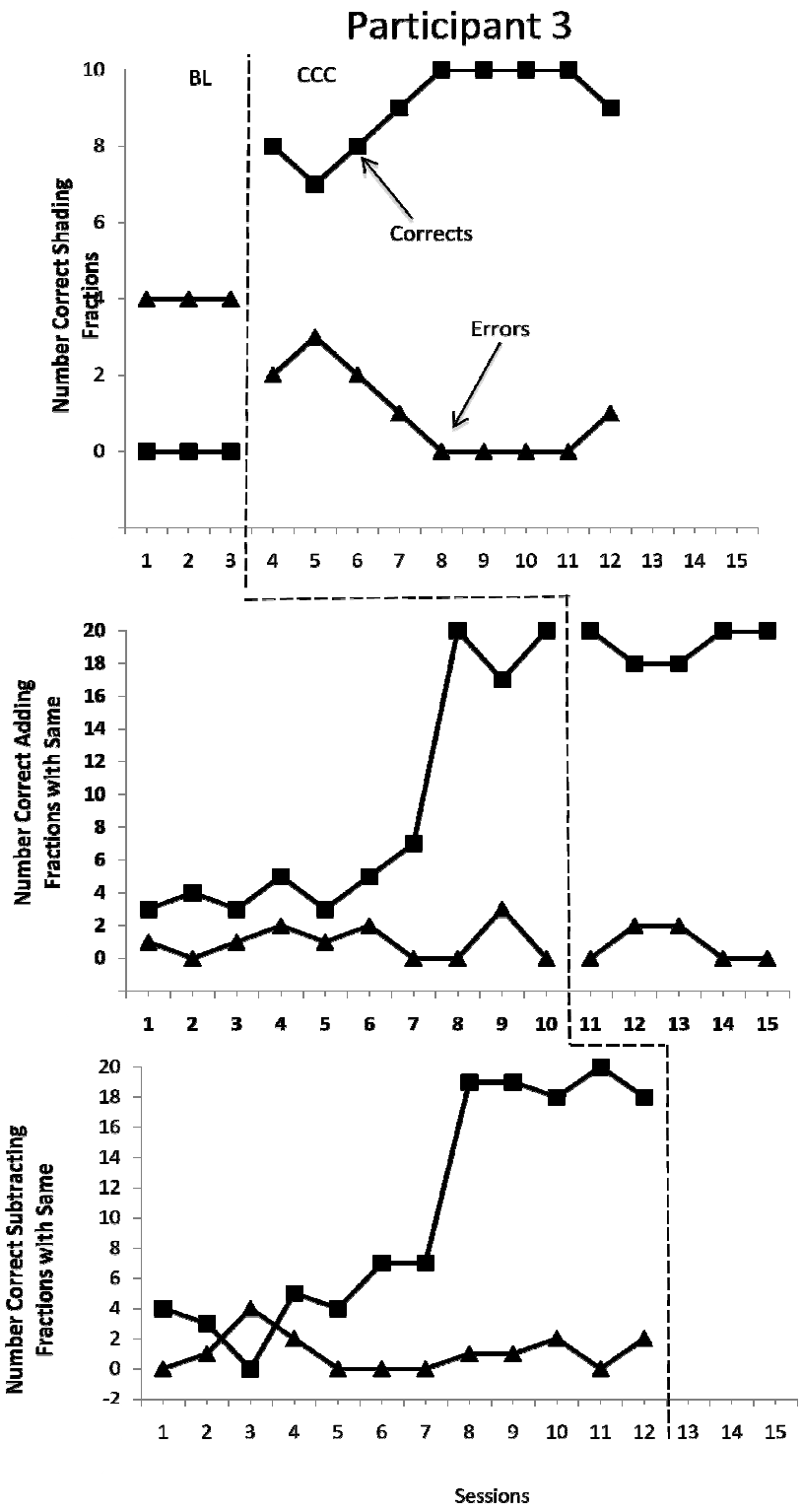

Figure 3. The number of corrects and errors for baseline and CCC.

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Table 1

Problems	Correct	Correct	Correct	Correct
¾				
1/3				
3/8				
1/6				
½				
3/7				
6/9				
11/13				
2/3				
2/10				
6/8				
2/4				
3/5				
1/3				

Table 2

Problems	Correct	Correct	Correct	Correct
3/5				
11/10				
13/15				
6/7				
7/8				
10/14				
9/10				
3/5				
10/8				
12/9				
12/15				
19/15				
8/9				
9/8				
4/5				
13/12				
8/7				
8/9				
15/13				
14/17				
21/20				

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Table 3

Problems	Correct	Correct	Correct	Correct
4/9				
4/17				
1/9				
1/8				
4/8				
6/15				
9/25				
1/9				
Problems	Correct	Correct	Correct	Correct
3/10				
7/18				
8/18				
5/16				
2/5				
2/13				
7/25				
9/30				
15/50				
8/20				
5/12				