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The Effects of a Peer Feedback Treatment Package on Math Performance in Students with Moderate Cognitive Impairments

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THE EFFECTS OF A PEER FEEDBACK TREATMENT PACKAGE ON MATH PERFORMANCE IN STUDENTS WITH MODERATE COGNITIVE IMPAIRMENTS

by

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Despite the increased demand for data collection in the special education settings, an agreed upon method for collecting data has yet to be identified. Two procedures that have demonstrated robust outcomes for collecting academic data for individual students are self-management and peer feedback. Self-management involves the student collecting measures on his or her own behavior(s). Peer feedback includes a student serving as a tutor and presenting academic materials and feedback to a tutee. Past research has yet to combine the two methods and include the methods to track and monitor Individual Education Program (IEP) goals. The current study aims to extend the literature in two ways, by (1) implementing a peer feedback package comprised of self-management and peer feedback procedures and measuring the effects on the accuracy of IEP goals and (2) measuring the accuracy required with the steps of the intervention package in order to achieve outcomes for the participants.

Keywords: self-management, peer feedback, special education, Individual Education Program, mathematics

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INTRODUCTION

Every child deserves a quality education; however, not every child receives one (Barret et al., 1991). Education seeks to better individuals and prepare them for a lifetime of learning. Effective instruction in education requires that special attention is paid to the quality of instruction in order to set students up for success. (Archer, 2011). Throughout the history of education, differing systems of measurement have been assessed in attempts to better education. Some of these measurement systems include teacher judgment and recommendation, written examinations, intelligence testing, and rubric scales (McArthur, 1983).

In 1913, the National Council of Education released a report about the standards for measurement in schools. The council stated that measurement should use scientifically derived scales that allow for accurate description of children's accomplishments and establish clear standards (Stayer, 1913). After the release of this report, it took many years for Congress to launch a study that empirically supported data collection and progress monitoring in schools.

In 1967, one study Congress initiated was Project Follow Through. The purpose of Project Follow Through was to determine which methods of instructional delivery were most effective in promoting learning and achievement in three domain areas: basic skills, cognitive skills, and affective skills. Basic skills included sound- symbol relationships, vocabulary words, word identification, math, punctuation, and word usage (Adams, 1996). Cognitive skills included measuring comprehension of written passage, knowledge of math relationships and principles, and reasoning with numbers (Adams, 1996). Affective skills included measurement to assess whether students attributed their successes or failures to themselves or other factors and measured how the students felt about themselves and the way they believe others and the school feels about them (Adams, 1996). A variety of tests were used to evaluate whether the students included in Project Follow Through were statistically different than the 2,000 other student comparison groups. Results indicated that Direct Instruction produced the most significant outcomes in all domain areas (i.e. basic, cognitive and affective skills) (Stebbins, 1977). Unfortunately, Project Follow Through's results are still largely ignored.

Decades later, a push for educational reform in America began to take place. In 2002, the No Child Left Behind (NCLB) Act was instated and intended to encourage the use of proven techniques to increase accountability for outcomes of education (Moran, 2004). This movement called for scientifically based research that includes rigorous data analyses, structured experimental designs and studies that were peer-reviewed from accredited journals (Moran, 2004,). Two years later, Congress instituted a reform to the Individuals with Disabilities Education Act (IDEA) (Individuals with Disabilities Education Act, 1997) which required states that accept federal funding to provide free and appropriate education to all students with disabilities. Specifically, IDEA stipulates that all students must have goals that provide appropriate educational opportunities with relevant time frames for completion of the goals. Each goal definition must be consistent with the academic goals made by the state for general education curricula (Cortiella, 2006). Through federal law, IDEA was established for students receiving special education services. IDEA created a process by which schools must develop an individualized education program (IEP), which was first established in 1975, by the

Education for All Handicapped Children Act. In 2004, IDEA's main focus was to require the IEP to become a legal binding document created by the public schools for students. The reauthorization of IDEA in 2004 changed the focus of IEPs from ensuring education for students diagnosed with a disability to improving the quality of the programs by increasing the accountability for results (Christle & Yell, 2010). The IEP includes the student's annual goals, supports and services to help the student achieve goals (e.g., accommodations for test taking), and how the school will measure these goals and transition planning. IEP goals ensure that students with disabilities are monitored in academic and functional progress. Each annual IEP goal is broken down into smaller objectives. Annual IEP goals are used to estimate the outcomes expected for the academic year based on the student's present level(s) of performance. Annual goals are divided into objectives or benchmarks to provide measureable steps for the student to achieve before completing the annual IEP goal (Lignugaris/Kraft, Marchand-Martella & Martella, 2001). Tracking the student's performance is a component of effective instruction.

To provide a student with effective instruction means to frequently measure the student's learning, which is tied to objectives, and to use the measured outcomes to make informed instructional decisions (Fredrick & Hummel, 2004). Measurement serves as a "reality check" and is viewed as the difference between opinion and actual change (Vargas, 2009). The educational setting is designed and constructed to change students' behavior. Measurement of behavior is crucial to the learning process because without measurement effectiveness of instruction is lost. For example, if a teacher never sets a goal for a student to achieve or includes objectives to measure a student's progress, how will the teacher be able to measure if a student has learned? Teaching and education deal with all kinds of student behaviors and without assessing student progress there is no way to tell whether learning is taking place (Vargas, 2009). The only way to know whether learning has occurred is to see a change in behavior. Measurement of behavior allows for the tracking of changes to occur. It is critical for teachers to have precise information on students' present levels of performance and how these relate to instructional objectives and progress monitoring. A student's present level of performance provides teachers with a baseline measure, this information enables them to select an achievable annual goal and break each goal down into short- term objectives. Measurement on each objective allows teachers to assess the student's progress towards the annual goal.

Currently, there are many educational programs that capitalize on measurement and progress monitoring such as Precision Teaching (Lindsley, 1992), Direct Instruction (Engelmann, Becker, Carnine, & Gersten, 1988), Personalized System of Instruction (Croft, Johnson, Berger, & Zlotlow, 1976), Morningside Academy Model (Johnson & Layng, 1994), and Explicit Instruction (Archer & Hughes, 2011). Each of these programs include systematic strategies to promote student achievement such as, identifying each student's present level of performance, placing the student properly within the academic skill, selecting a goal and creating objectives for the student to reach before achieving the goal, collecting repeated measures on the student's performance and frequently examining and reevaluating student's growth of learning based on the data collected.

Within all of the abovementioned programs, a measurement system to track progress is included. One way to measure a student's progress is to use Curriculum-Based Measurement (CBM). CBM is a method that is first used as a screening tool to assess a student's present abilities with academics (Kettler & Albers, 2013). Information gathered from an initial CBM is used to determine each student's baseline abilities and placement in academic programs. Once a student is properly placed, long-term goals and objectives can be formulated. Incorporated into CBMs are tests that are designed to reflect a summative assessment of the learner's skills with the curriculum (i.e. survey-level CBM) and a more frequent repeated measure to monitor the learner's progress (i.e. focused-level CMB). CBM procedures include characterizing a student's performance in basic content areas, then academic objectives are written to include specific measurement standards and evaluation procedures. Survey- level CBM procedures are direct and serve as a starting point for instruction and creating materials for more frequent test probes and progress monitoring. Focused –level CBM procedures are direct, require a short time period and should be used repeatedly and frequently. CBMs are normed assessments, which can be used to develop criteria at an individual, class or school level. Focused-level CBMs have the ability to be used as a sensitive measure and delivered as frequently as two to three times a week (Hartman & Fuller, 1997). Research supports findings that special education teachers who are using CBM procedures to follow students' progress with instructional goals make data-based decisions and utilize objective data more than teachers who do not (Fuchs, Fuchs & Bishop, 1992). This information is important because CBM data is sensitive to change since the assessments take place so frequently; moreover, knowledge of the effects of instruction is available within weeks (Hartman & Fuller, 1997).

Another way teachers can collect data on student progress within the classroom is the use of self-monitoring (Ferretti, Murphy & Murphy, 1993). Self-monitoring interventions typically include the student being taught to record whether or not a specific target behavior(s) has or has not occurred. Self-management is delivered as a treatment package and typically involves specific components, which can include all or a combination of the following behaviors: goal setting, strategy selection, self-monitoring, self-evaluation, and self-consequation (Ferretti, Murphy, & Murphy, 1993). In the classroom, a student and teacher would select a behavior and identify how the student would monitor the behavior. The student would then begin self-monitoring by collecting data on his or her own behavior for an established period of time. Once identifying the present level at which the student exhibits the behavior, the teacher or student would identify a criterion or goal for the student to increase or decrease the monitored behavior providing an impetus for the student to begin to self-evaluate. Self-evaluation (also commonly referred to as self-assessment) involves comparing performance against predetermined goals or standards. Self-evaluation can then lead to self-consequation, in other words, the student makes a decision as to if a reward should be delivered or not (Ferretti, Murphy, & Murphy, 1993). Having students track and monitor their behavior has many advantages in the classroom. One desirable outcome of self-monitoring is that the student's behavior will change due to reactivity; however, reactivity is typically short-lived. Reactivity is the effects of an observation and measurement procedures on behavior that is being measured; moreover, reactivity is more likely to occur when the person has an awareness of what is being measured. Reactivity is hoped for because it leads to a behavior change due to the process of self-recording without the addition of extrinsic consequences. It may be important to include other components in the self-management package for lasting change. Successful self-management treatment packages often include, a target behavior that was already in the student's repertoire, external contingencies at first to help maintain self-management procedures, and external rewards provided for successful self-management (Ferretti, Cavalier, Murphy & Murphy, 1993). When a student self-monitors, teachers are free to attend to other classroom needs and instruction; they do not have to find time to monitor the student while simultaneously engaging in other tasks (Webber, Scheuermann, McCall, & Coleman, 1993). In addition, generalization and maintenance have been demonstrated once a student learns self-management (Nelson et al., 1991). For example, students have demonstrated the ability to generalize the skill taught through self-management to different settings and situations over an extended period of time.

To further evaluate the essential components of self-management procedures, Spates and Kanfer (1977) researched self-monitoring, self-evaluation and self-reinforcement. The purpose of the investigation was to determine if self-monitoring alone could lead to a significant change in arithmetic performance or if self-evaluation (i.e., student instructed to finish problems, look to see whether he did the problem correctly, and state "I'm right" or "I'm wrong") was needed in addition to self-monitoring to achieve desirable results. The study used a group design to evaluate self-monitoring, criterion-setting, self-evaluation and self-evaluation plus self-reinforcement for 45 first grade students who were randomly assigned to one of the four conditions. Pre and post measures represented by a math grade were used to determine the effect of arithmetic grades and results indicated that significant effects were found after training in self-evaluation alone and with other procedures. This experiment supported past literature findings that self-monitoring alone would not produce a significant effect and including a criterion to which behavior is compared (i.e. self-evaluation) demonstrated the largest effect. While promising results were obtained, a limitation is that students' accuracy with the self-regulation model was not measured. This limitation is important since it is critical to know how accurate students must be in implementing the model as it may provide vital information regarding the degree to which accuracy influences the degree of desirable outcomes.

Measuring the degree to which a procedure is implemented accurately helps to determine what level of accuracy or precision is needed for the procedure to be effective. Cavalier, Ferretti, and Hodges (1997) measured accuracy in their research examining the effects of a self-recording procedure on students' inappropriate verbalizations. The researchers used a multiple-baseline across subjects design for two students during typical classroom activities. The treatment included training the students to self-record accurately and to a set criterion level for accuracy (i.e. student was to accurately record the occurrence or nonoccurrence of behavior with 85% accuracy for four consecutive sessions). During level 1 of the intervention, accuracy checks were required for all sessions and each student was to self-record with at least 85% accuracy for four consecutive sessions. If the performance criterion for accuracy of self-recording was achieved the student would receive a reinforcer. Level 2 and 3 are different than Level 1 in that accuracy checks were delivered only once a day and without the student's knowledge of when the checks would transpire. Once the checks occurred, if the student was at or below the pre-established performance criterion for inappropriate vocalizations a reinforcer would be delivered. Results demonstrated that the self-management system reduced inappropriate vocalizations to a near zero level for both students providing empirical evidence that there is a relationship between introducing a self-management package and decreasing inappropriate behavior. The authors noted that further reductions in the occurrence of inappropriate behaviors decreased the more the student improved the accuracy of their own self-recording. Once each student's self-recording began to map onto those of the observers with 100% accuracy, inappropriate behaviors continued to steadily decrease and remained below performance criteria. This study demonstrated that measuring accuracy with self-recording can attribute to positive results of behavior change strategies.

Self-recording and self-management interventions can be utilized to decrease inappropriate behavior but also increase appropriate behavior. One behavior of interest to increase may be related to academic performance. In 1973, Knapczyk and Livingston investigated the use of self-recording in combination with a token economy system by having thirteen seventh, eight, and ninth graders record their percent of correct responses on daily reading assignments. The researchers utilized a reversal design to identify the experimental variables that were most effective within the treatment package. Students were told they would earn money based on the accuracy of their recorded reading performance. At the end of the week, students would receive their payment and get to purchase in class activities. Results of the investigation suggested that once the token economy system was brought into the classroom, there was a higher level of reading performance compared to baseline. Changes in reading performance occurred due to the self-recording and the token economy system. Additionally, students were able to maintain their own records without it affecting performance. There was not a significant difference between the conditions evaluated in this investigation. Taken together, these results indicate that students are able to assume responsibility of maintaining their own record of performance without it negatively impacting their reading performance. As a limitation, the researchers identified some variability during performance because the reading material was not consistent; some days students would be working on new material and on other days practicing review material. A more systematic analysis of developing and programming materials may assist in reducing the amount of variability in performance. In addition, students may be able to sustain and implement the self-recording procedure if peers are involved in recording and delivering the consequences for self-recording which could also help to facilitate generalization and maintenance of the skills.

There are many advantages to including peers as intervention agents. Strain, Cooke, and Apollone (1976) noted that peers may be able to observe and deliver consequences for a student's behavior more often than the teacher. In addition peers are in more settings with the student and the presence of a peer may serve to cue the student to engage in desired behaviors that may lead to maintenance of the behavior.

Carden Smith and Fowler (1984) evaluated the effects of peer monitoring on student disruptive behavior for eight students ranging from age five to seven years old in a two-part investigation. In the first study, the use of a teacher implemented token system and peer implemented token system were systematically evaluated using a reversal design on student's participation, disruptive behavior, teacher prompts, and teacher praise to the students. Results suggested that during teacher monitored and peer-monitored conditions the students' disruptive behavior decreased and participation increased. The level of student participation also increased during teacher and peer monitored conditions. Thus, peer monitoring with corrective feedback may be just as effective as teacher monitoring. In the second part of their study, peer monitoring without teacher monitoring first being implemented was investigated and whether corrective teacher feedback was needed for peer implementation to be effective. Results suggested that once the token system procedure was established, peer monitors were able to administer it without the teacher feedback. Taken together, this study provides clear empirical support for peer involvement in classroom procedures to assist in changing behaviors of other students to measure their progress. This study demonstrates the benefit of involving students in behavior management programs which can help reduce the teacher's responsibilities of supervision and offers an alternative to the demand for progress monitoring put on classroom teachers.

Further investigating the effect of including other students to change the behavior of their peers, Schloss, Kobza, and Alper (1997) conducted an experiment to determine whether using reciprocal peer feedback with individuals with moderate mental retardation would have an effect on the correct use of money exchange procedures. A multiple baseline across subject dyads (six students were grouped into three pairs of two students each) was used to evaluate the effect of the reciprocal peer tutoring peer procedure. Results of the intervention demonstrated that once the dyads were exposed to the peer tutoring process, correct responses in the money exchange procedure were demonstrated and students required less prompting to complete the peer tutoring procedure correctly. Collectively, the investigation demonstrated that peer tutoring may lead to accuracy of procedures once the intervention is implemented.

Further illustrating this effect, Mayfield and Vollmer (2007) evaluated the effects of peer tutoring on math skills in at-risk students serving as peer tutors for other at-risk students. All participants were grouped into pairs forming a dyad in which each participant served as both the tutor and tutee. The authors served as the expert tutor providing 3-minute tutoring sessions to the peer tutor on math skills. The peer tutor would then go on to provide a 3-minute tutoring sessions on the same skill to the tutee. Results of the intervention were displayed for each dyad using a multiple baseline design across math skills. The intervention demonstrated the math skills of the tutor and tutee both improved and maintained three to five months after the intervention with no practice. In addition, accuracy levels maintained high for 7 of the 12 skills assessed during maintenance probes. The authors discussed that these results suggest that students can improve their math performance without supplemental instruction from an expert and without highly structured procedures.

A recent meta-analysis further evaluated the benefits and limitations of peers as tutors, (Bowman-Perrot et al., 2013). The authors defined peer tutoring as an instructional strategy that involves the students helping other students learn content through repetition of key concepts (Bowman-Perrot et al., 2013). Positive effects from peer tutoring were reported in the analysis across subjects such as, math, social studies, and science. Peer tutoring has also been shown to be effectives across a wide range of settings (e.g. general education classrooms, resource rooms, and self-contained rooms) (Bowman-Perrot et al., 2013). The analysis revealed that the core components of peer tutoring (i.e. increased opportunities to respond and error correction procedures) are enough to make an impact on student outcomes (Bowman-Perrot et al, 2013). In addition, the meta-analysis indicated that the majority of studies did not collect social validity of consumer satisfaction. Of the studies that did collect a social validity measure via questionnaires or surveys, both teachers' and students' satisfaction ratings were high. Teachers identified that the procedure was easy to implement with their existing classroom routine and structure. Bowman- Perrot et al., reported several limitations to the current research on peer tutoring including treatment fidelity of the student acting as the peer tutor, examining the outcomes for students diagnosed with autism and other disabilities and social validity measures for students and parents.

Other interventions that have brought peers into a critical role include studies that taught students to recruit feedback and attention from their peers. Alber and Heward (2000) report that teaching students to recruit attention from their peers is a way to gain success in the classroom and promote the likelihood of the student fitting in socially and academically. For example, Mank and Horner (1987) examined whether a functional relationship existed between maintenance of work rate, productivity and self-recruited feedback for five participants with cognitive impairments in the workplace. Self-recruited feedback included three components: self-monitoring, self-evaluation and recruitment from the external environment (e.g., peers). In addition to measuring work rate and productivity, the researchers also measured each participant's accuracy with self-recruited feedback. Results of the intervention demonstrated an increase in work rate and productivity once self-recruited feedback was introduced. Overall, participants' accuracy of self-monitoring work productivity ranged from 85% to 98% and accuracy of self-monitoring for work rate ranged from 62% to 92%. Of the three participants who entered the self-recruitment phase, accuracy with independent data recorders (i.e., IOA measures) for self-evaluation for recruiting feedback averaged 95%. This study supports the functional relationship between self-recruited feedback and work rate for individuals with cognitive impairments in the work place. Future studies need to examine the use of peers for the delivery of feedback for individuals with cognitive impairments in the school setting.

In 2001, Wolford, Heward and Alber taught four eighth graders with learning disabilities how to recruit assistance from other peers during cooperative learning activities in general education classrooms. The students were taught to show their work to peers and ask “Can you help me?” or “How am I doing so far?” A multiple baseline across students design was used to demonstrate that recruitment training increased the rate of recruiting responses by the participants, the rate the participants received feedback and praise from peers and the productivity as well as accuracy with which the participants completed their assignments. Accuracy with which each student completed their assignments increased from baseline to post training ranged from 86% to 100%, 94% to 100%, 92% to 100% and 91% to 100% across the four participants. Results of the intervention suggest that middle school students with learning disabilities are able to recruit attention from their peers. The authors state within the discussion that future research should examine the effects of students recruiting assistance from peers in other academic settings and activities such as social studies, science and math.

Previous literature has examined the use of including peers in different roles to aid in mediating or assisting in the implementation of academic interventions. In 1990, Kolher and Strain wrote a literature review of four types of peer-assisted interventions. They stated that peers may serve as an intervention agent in four ways: a) peer management, b) peer tutoring, c) peer modeling, and d) peer participation in a group-oriented contingency.

Peer management is a strategy used to teach a peer to prompt and provide consequences for nonacademic behaviors of a selected student. In 2014, Dart, Collins, Klingbeil and Mckinley further refined Kolher and Strain's (1990) review by conducting a meta-analytic review of the most up recent peer management literature. The authors found that school-based peer management interventions involved training students to implement a very standardized protocol with one or more selected students to address behaviors that are not academic skills but rather academic engagement. Academic engagement is considered to be under the nonacademic domain because although academic engagement is needed for learning to take place, it does not ensure an increase in academic skill performance. Peer management requires the student serving as the interventionist to verbally or physically prompt a response from a selected student, appropriately deliver reinforcement, and block responding for other specific behaviors. The results of the meta-analysis revealed that peer management interventions have a moderately high effect size. The authors discussed how overall peer management interventions are under-researched especially in comparison to other peer mediated interventions and suggested that future investigations need to focus on the precise amount of adult time and effort needed to train peers to accurately and independently implement the peer management interventions. In addition, more research is needed to determine if peer implemented interventions maintain in the school setting after training has been discontinued.

Research Questions

This study aimed to investigate past research limitations by evaluating the effects of a peer feedback package that includes a self-score, evaluate and check procedure on math performance in students with moderate cognitive impairments. The present investigation sought to answer the following questions:

1. What is the effect of a peer feedback package on students' accuracy of achieving their math performance goals?
2. To what extent does a student have to implement the peer feedback package with accuracy to demonstrate significant change?

METHOD

Participants

Four participants were recruited from a self-contained special education center based school in a Midwestern state. The self-contained school serves approximately 117 students from grades preschool to twelfth grade. Student to teacher ratio is three to one The range of student diversity is White (59.6%), Hispanic (25.7%), African American (13.8%) and Asian (.9%) with roughly 59% male and 41% female. Students attending the school have a variety of diagnoses and are able to attend the school from birth to age twenty-six. Inclusion criteria included a diagnosis of Cognitive Impairment as defined by the school, the ability to match numbers and words to written samples as reported by teacher, an math IEP goal, the ability share/exchange short sentences with peers and an age of less than eighteen-years-old. The Diagnostic and Statistical Manual (DSM-5) defines Intellectual Disability or Cognitive Impairment as a disorder with onset during the developmental period, which includes intellectual and adaptive functioning deficits in conceptual, social, and practical domains. Inclusion criteria were verified by teacher report and documents in the school database system, TIENET ("TIENET," 2016). The cut-off age of eighteen-years old was selected because it is the age students typically graduate and leave secondary school settings. Students who were unable to match to sample, share with peers, and did not have a math IEP goal were excluded. Participants were grouped into three separate dyads based on the classroom each attended.

Dyad One included, Laura and Yanni. Both participants attended a full day of school in a in a self-contained classroom for students ages 9-12 years old with moderate cognitive impairments. Student to staff ratio was 15:3. For all sessions, Dyad One sat at a square table in the corner of the classroom during independent work time. All sessions were conducted at 8:50 a.m.

Laura was a 9-year-old Caucasian female with Down syndrome and a primary diagnosis of cognitive impairment. Laura's IQ composite score was 55. Laura was able to vocally express wants and needs using full complex sentence structures (e.g. "Can I have my snack, please?" "Yay! I have a match!"). Laura's teacher developed annual math goal was to add and subtract two numbers with a sum of up to 18 using touch points with 80% accuracy.

Yanni was an 11-year-old Hispanic female with a primary diagnosis of severe multiple impairments which included Jacobsen's syndrome, Coloboma, and Congenital Thromboctopenia. Yanni's IQ composite score was 47. Yanni was able to vocally express wants and needs using one to two words (e.g. "Help please," "Lunch time"). Yanni's teacher constructed annual goal was to add groups of objects or pictures with a sum of up to 10 with 80% accuracy.

Dyad Two included Noel and Brad. Both participants attended a full day of school in a self-contained classroom for students ages 12-15 years old with moderate cognitive impairments. Student to staff ratio was 14:3. For all sessions, Dyad Two sat at a round table in the corner of the classroom where students in the class completed their independent work. Sessions took place at 8:30 a.m. except on Fridays when sessions were conducted at 12:00 p.m. due to Brad arriving to school at a later time because of a standing Occupation Therapy (OT) appointment.

Noel was a 12-year-old Caucasian female with a primary diagnosis of cognitive impairment. Noel's IQ composite score was 66. Noel was able to vocally express wants and needs using three to five words (e.g. “I need help,” “Will you come here?”). Noel’s teacher developed annual math goal was to rote count using touch points or pictures numbers 10-20 with 80% accuracy.

Brad was a 12-year-old Caucasian male with a primary diagnosis of cognitive impairment. An IQ composite score was not available for Brad. Brad was able to vocally express wants and needs using full complex sentence structures (e.g. “Is Ms. Allaina here today?” “Hey! What are you doing here?”). Brad’s teacher developed annual math goal was to correctly add 10 and subtract 10 single digit problems using numbers 0-15 on a number line with one to two prompts.

Dyad Three included Robert and Nathan. Both participants attended a full day of school in the same self-contained classroom as Dyad Two. For all sessions, Dyad Three sat at a round table in the corner of the classroom where students completed their independent work. All sessions were scheduled for 8:30 a.m. except on Thursdays when sessions were conducted at 11:00 a.m. due to morning gym class.

Robert was a 12-year-old Caucasian male with a primary diagnosis of cognitive impairment. An IQ composite score was not available for Robert. Robert was able to vocally express wants and needs using full complex sentence structures (e.g. “Ms. Allaina, will you be working with me today?” “I had a good weekend with my mom.”). Robert’s teacher developed annual math goal was to add and subtract 10 math problems between numbers 0-20 with one to two prompts.

Nathan was a 15-year-old Caucasian male with a primary diagnosis of cognitive impairment. Nathan’s IQ composite score was 72. Nathan was able to vocally express wants and needs using full complex sentence structures (e.g. “Today, I need to lead the calendar then I can work with you." "Do you know what time Patrick will be in today?"). Nathan's teacher developed annual math goal was to count an assortment of coins and bills up to $5.00 in three out of five trails.

An IEP goal probe test (see Appendix H) was conducted prior to the student commencing baseline to determine if the student had already achieved his/her annual IEP goal and to identify the student's current skill level. If a student met his/her IEP goal during the probe test, the researcher reported the information to the teacher to develop a new goal and the IEP probe assessment was repeated for the newly constructed goal (see Appendix J for researcher constructed goals).

Materials

Materials for the study consisted of a self-score form (see Appendix C), IEP probe tests (see Appendix H), worksheets (see Appendix H), worksheet answer keys (see Appendix H) and highly preferred items for the student. Preferred items were identified through a Multiple Stimulus without Replacement (MSWO) preference assessment (Carr, Nicolson, & Higbee, 2000) (See Appendix K). Each student had a self-score form (see Appendix A), which was completed using a writing utensil (e.g. marker, pencil, pen). All forms and paperwork used were printed on paper that was 8.5 inches by 11 inches. All answer keys were laminated. All forms were kept in a locking file folder box (17.5 inches by 14 inches by 12.5 inches) in the classroom. Other materials included data sheets (see Appendix B), pens or pencils, and folders to hold such materials.

Setting

The setting for the study was at a center-based school that included self-contained classrooms in a Midwestern state. All classrooms within the school included typical classroom features (e.g. desks, chairs, white board, adequate lighting, computers).

Independent Variable

The study implemented a peer feedback package intervention comprised of four distinct components that included: self-score, programmed opportunities for self-evaluation, programmed opportunities for peer checking, and a point system. Students implemented the peer-feedback package once daily during scheduled morning independent work time. The first self-score, involved the student marking his/her score after completing the math assignment. For example, the student would count the number of correct answers completed and write the number at the top of the worksheet. The second component of the intervention package included programed opportunities for the student to evaluate his/her performance against a pre-established criterion. The self-evaluation component involved the student comparing his/her own scored number against the set criterion determined on their self-score form. The researcher created a terminal goal for each student based on his/her math IEP goal. The goal was constructed to allow for more accurate measurement and data collection. Each student had a terminal goal that was broken down into slices. All slices served as sub goal towards achieving the terminal goal. (See Appendix J for all participants constructed goals). For example, if Laura correctly completed two problems she wrote that number at the top of her worksheet. She then compared the number correctly completed to the phase criterion written on her self-score form by pointing to the number on her self score form and circling whether it was a match. A non-example of this was Laura writing the number of completed problems without pointing to the number and comparing the number to a predetermined goal located on her self-score form. The third component of the treatment package included programmed opportunities for a peer to check the accuracy of the student's own evaluated performance. This component involved the student delivering materials to and receiving materials from a paired student. The peer checker reviewed the student's assignment, checked to see if he/she wrote the correct number at the top of the worksheet, circled on the self-score form whether the student did or did not meet his/her predetermined goal and circled the score the student received. For example, if Laura received Yanni's worksheet, self-score form, and assignment answer key she would compare Yanni's answers to the answer key and write the correct number of completed answers at the top of the worksheet and compare that number to the phase criterion. The peer checker (Laura) circled a match (e.g. "+"/"+" or "-"/"-") or a mismatch (e.g. "+"/ "-"or "-"/ "+"), which lead to the last component. The final component was a point system based on accuracy of self-evaluation and accuracy of math problems. This point system involved providing the student with points based on accuracy of recording and achieving goals. For example, if Yanni and Laura both circled the "+" sign, Yanni received two points for that day, if Yanni and Laura both circled the "-" sign, Yanni received one point for the day or if Yanni and Laura had a mismatch (e.g. "+"/ "-") Yanni received no points for the day. The peer checker, Laura, circled the amount of points earned and returned the self-score form to Yanni. The peer feedback package training was introduced to both students in the student pair at the same time (see procedures section for training details).

Dependent Variables

The primary dependent variable was accuracy of completed math problems by measuring each problem for whether it was correct or incorrect. If the student completed the problem correctly it was scored as accurate. If the student made an error on the problem it was scored as inaccurate. If a problem was not answered it was also scored as incorrect. The percentage correct was calculated by dividing the total number of problems correctly answered by the total number of problems possible (i.e. correct, attempted and incomplete problems) and multiplying the quotient by 100%. In addition, the accuracy of the peer feedback procedure was evaluated. Accuracy of the use of the peer feedback procedure was defined by how many steps of the task analysis for each role the student completed correctly (see Appendix B). Training sessions continued until both students in the dyad achieved 100% accuracy for two consecutive days. At the end of each session, data was collected and graphed for each student. Accuracy with the peer feedback components (i.e., self-score, evaluate and check) was collected using the task analysis datasheet for each role, which was collected using live data collection measures. The number of correct steps implemented was calculated by dividing the number of correct steps by the number of total steps possible and multiplied by 100, to report the percent correct. Percent correct data were plotted on a multiple baseline line graph for each student.

A secondary dependent variable, frequency of math comments, was also collected throughout the study. Math comments were categorized as either positive or negative. A positive math comment was defined as a student making some vocalization pertaining to his/her own or others' math performance in a *favorable* way, students may have also been engaging in the following behaviors: smiling, laughing, or yelling with a smile (e.g. "Yes! I made my slice"); however, it was not required to fit the definition. A negative math comment was defined as the student making a vocalization pertaining to his/her own or others' math performance in a *negative* way, students may have also been engaging in the following behaviors: frowning, crying, or yelling without smiling (e.g. "I hate math"); however, it was not required to fit the definition. Math comments were collected 10 minutes before, during, and 10 minutes after each session. Researchers tallied each occurrence during the observation times. The total number of math comments were collected by tallying each math comment made and reporting the number as a total frequency. Total session frequency data were plotted on a multiple baseline graph for each student.

Data Collection

Accuracy of completed problems was collected after each session (see Appendix C). Treatment fidelity was collected for 30% of training sessions via live data recording (see Appendix E and G). Data were graphed using a line graph and analyzed after all sessions for possible intervention impact.

Research Design

A multiple baseline across student pairs (Cooper, Heward, & Heron, 2007) was used to evaluate the effects of the peer-feedback package on student's accuracy with their IEP goal and accuracy with the peer-feedback package. Dyad One and Dyad Two began baseline at the same time, Dyad Three began baseline later on during the study. The independent variable was introduced in a staggered fashion to one dyad at a time.

Intervention was first introduced to Dyad One and both students in this dyad were provided training for the peer-feedback package simultaneously. Once stable responding was demonstrated for Dyad One, the independent variable was applied to Dyad Two. Dyad Three remained in baseline until steady responding was demonstrated then the independent variable was introduced. Accuracy of math problems continued to be collected at the end of each session throughout study.

Procedure

Summary

Students were tested to determine whether or not they achieved their IEP goal. The researcher created a terminal goal based on each student's current IEP goal (see appendix J) and the terminal goal was then broken down into slices. Each slice served as a benchmark toward the terminal criterion (see Appendix J). Once all students had a current math goal, they were matched with another student.

Individualized Education Program Testing

Prior to beginning the study, all students were tested to see if they have already achieved their IEP annual goal. IEP testing was conducted across five consecutive school days. During IEP testing, the researcher presented a test based on each student's teacher developed IEP math goal (see Appendix H). The student was allotted 15 minutes to complete test and they were required to complete it independently to the best of their ability. The timeframe of 15 minutes was selected because this is the amount typically provided for the classroom students to complete relevant worksheets and tests. The researcher stated "okay" in a neutral voice after the test time was up or if the student indicated to the researcher he/she had finished. To avoid the potential for learning during these test conditions, additional programmed consequences were not delivered based on any other student response. Prior to baseline, teachers were provided with a standardized script (see Appendix L) to use if students interacted with them about their progress towards their math goal. If the student stated a negative remark about his progress towards his math goal (e.g. "I never make my slice!") the teacher would state, "Remember to keep trying and maybe tomorrow you will beat your score!" If the student stated a positive remark about his progress towards his math goal (e.g. "I beat my slice today!") the teacher would state, "That's great! Keep trying and maybe tomorrow you will beat the next slice!"

Baseline

The math goal worksheet was presented for each student to complete and no additional prompts were delivered. If the student asked questions during the worksheet, the teacher responded, "try your best and if you are not sure on a question, you can skip it." At the end of each day, the researcher reviewed each student's progress toward the math goal.

After stable responding in baseline was demonstrated, the peer-feedback package training was implemented with the first dyad, as described below.

Self-score, Evaluate and Check Training

Dyad One was selected to receive peer feedback package training first. Explicit instruction using a model, lead, and test model (see Appendix E and G for a checklist of each training) was used to train the students on the peer feedback training package. For the training, the researcher was seated facing the student and provided the student with the worksheet and instructions to complete the worksheet. Prior to beginning the worksheet, the researcher modeled for the student where to find the self-score sheet and where to locate the slice criterion. All slice criteria were located on the back of the self-score sheet. After 15 minutes had elapsed or after the student indicated he/she was finished with the worksheet, the researcher modeled obtaining the answer key. The researcher modeled going through each problem and stating aloud whether the answer was a match. If the worksheet answer matched the answer key, the researcher placed a "+" next to the problem. If the worksheet answer did not match the answer key, the researcher placed a "-" next to the problem. After progressing through each problem, the researcher then modeled tallying the "+" marks and writing the total number of "+" marks at the top of the worksheet. After totaling the number of correct answers, the researcher modeled matching the number correct to the slice criterion number written on the self-score form. If the number was at or above the slice criteria, the student circled a "+" mark in the allotted space. If the number was below slice criteria, the student circled a "-" mark in the allotted space. After completing the self-score form, the students waited until a vocal signal (i.e. "Time to switch with your partners") was provided from the researcher that it was time to switch materials with the other student in the pair. Switched materials included: worksheet, self-score form and answer key. The peer checker placed a "+" mark next to the matched problems and a "-"next to the problems that did not match the answer key. The peer checker added up all of the "+" marks and wrote the total on the top of the worksheet. If the student was at or above the slice criterion, the peer checker circled a "+" mark next to the student's previous marked sign and returned all the documents back to the student. During training, researchers would wait three seconds from when the student was to perform a task before delivering a vocal prompt (e.g.

"What is next?" "Is this a match?"). If the student did not answer or answered incorrectly, the researcher would model the correct answer and then have the student practice the correct answer before moving on to the next task. Training session criterion of 100% accuracy for two consecutive sessions for each student in the dyad was initially established; however, no students in all of the dyads passed the training criterion. In addition, all the students showed the most independence while getting out their materials (i.e. worksheet, self-score form, and answer key). All of the students needed the most prompting with checking for accuracy their own work and the work of their partner.

Original Point System

The original point system aligned with that which was being used for all programs for other target behaviors in the two identified classroom settings. At the end of each week, students added up their points indicated on their self-score form. The students could exchange their points for items identified from their preference assessment. Students had to cash in all of their individual points at the end of the week, as points could not roll over to the following weeks. If students did not select an item(s), the researcher conducted another preference assessment. If the student had a "+/+" match, two points were circled by the peer checker for the student. If the students had a "-" match, one point was circled by the peer checker for the student. If the students had a mismatch "-/+" or "+/-"zero points were provided to the student.

At the end of each day, the researcher reviewed each student's progress towards his or her math goal. If a student met his/her goal or met the phase change criterion for two consecutive days, the researcher moved the student onto the next slice or developed a subsequent goal to ensure the student would be able to participate in the study.

Modified Point System

A modified point system was designed for Dyad One due to a lack of motivation that was noted to finish the math worksheet. At the beginning of each session, Laura and Yanni were reminded of their score the day before (e.g. "Yesterday, your score was 5 out of 10). After the researcher reminded them of their score, Laura and Yanni were told that in order to obtain a prize, they had beat their score from the previous day. In addition, Laura and Yanni were provided with pens to complete their worksheets. They were instructed that if they began to scribble on their worksheet, they work be switched back to a pencil. Once both Laura and Yanni finished their worksheets, they would each independently score their work. If each student beat their score from the day before, a "+" was circled; if the number correct was not better than the previous day a "-" was circled instead. The dyad then switch materials and score each other (as in the original methods). If the partner beat her score from the day before, a "+" was circled, but if the partner did not beat her score, a "-" was circled instead. If both students had a "+/+" match, two points were circled by the peer checker for the student. If the student had a "-/-"match or mismatch, zero points were provided to the student. Laura and Yanni were only able to earn access to rewards if they beat their own score from the day before. Additionally, only if each student beat their own score would either of them be able to access their most preferred reward which was contingent on achieving the current slice (e.g. 8 out of 10).

Interobserver Agreement

Interobserver agreement (IOA) for math accuracy was collected for 33% of all sessions. Each worksheet problem was marked as accurate or inaccurate by the researcher or data collector. Accuracy was measured by checking each problem for whether it is correct or incorrect. If completed correctly, it was scored as accurate. If the student made an error on the problem it was scored as inaccurate. If a problem was not answered it was also scored as incorrect. The percentage correct was calculated by dividing the total number of problems correctly answered and by the total number of problems possible and multiplying the quotient by 100%.

IOA was computed using a trial-by-trial formula (Cooper, Heward, & Heron, 2007) (see Appendix H for example of trial by trial). Agreement on a trial occurred if both observers independently scored that an answered problem did or did not match the answer key (see Appendix I for example of answer key). A disagreement occurred if the observers recorded different responses for a particular problem (e.g. one observer wrote down that the answer was correct and the other observer wrote down incorrect). IOA was collected by a research assistant via permanent product recording and calculated by dividing the number of agreements by the total number of agreements and disagreements and represented as a percentage. For Dyad One, mean IOA scores for Laura were 99% (range, 90%-100%) and Yanni 96% (range, 80%-100%). For Dyad Two, mean IOA scores for Nicole were 100% and Brad 98% (range, 90%-100%). For Dyad Three, mean IOA scores for Robert were 98.5% (range, 90%-100%) and Nathan 97% (range, 90%-100%).

In addition, Interobserver agreement (IOA) was collected for 34% of student performance on the implementation of the peer feedback performance data. For Dyad One, average IOA mean score was 77% (range, 57%-100%). For Dyad Two, average

IOA mean score was 97% (range, 93%-100%). For Dyad Three, the average IOA mean score was 88% (range, 78%-100%).

Treatment Integrity

Treatment integrity was collected for 30% of all sessions. A research assistant collected treatment integrity via live data recording with the use of a treatment integrity checklist (see Appendix E and G). IOA was collected for treatment integrity 30% of all sessions. The agreement of trial-by-trial agreement was used to determine IOA (Cooper, Heward, Heron, 2007) of treatment integrity. For example, both observers must have agreed that a particular step did or did not happen in the integrity checklist to achieve agreement. Each step in the checklist was considered a trial. At the end of the session, the observers divided the number of trials with agreement by the total number of trials with agreement and disagreement and multiplied that number by 100. For Dyad One, IOA mean score was 92% (range, 74%- 100%). For Dyad Two, IOA mean score was 91% (range, 86%-95%). For Dyad Three, IOA mean score was 97% (range, 94%-100%).

Social Acceptability

Social acceptability was collected at the end of the study from students and teachers using a short survey. Social acceptability was measured using a Likert scale (i.e. scale from 1 to 5). The primary researcher individually asked each teacher and student about the intervention from questions located on the survey. After each response, the researcher indicated the response from the teacher or student on the survey. Teachers and students had the option to choose from strongly agreeing (i.e. 1) to strongly disagreeing (i.e. 5). See Appendix I for the survey. If the teacher or student chose not to complete or participate in the survey, the researcher thanked them for their time and discontinued the survey.

RESULTS

Results of the intervention are displayed for each dyad in the graphs below. Math performance for each dyad can be found in Figure 1. Peer feedback treatment package performance data for each dyad are displayed in Figure 2. Math comments made by each participant can be found in Figure 3.

Dyads

Dyad One

Dyad One, Yanni and Laura are in the top panel of the graph for Figures 1 and 2. Throughout baseline and intervention, both Yanni and Laura's math performance were variable (see Figure 1). Yanni and Laura ended intervention with a modified point system. During this phase, Yanni and Laura both received their highest score. For treatment package performance, both Yanni and Laura's performance remained low during intervention. During intervention with modified point system, Yanni and Laura performance steadily increased demonstrating a slight increasing trend (see Figure 2). After being introduced to intervention, Laura had a cumulative of 14 math comments made during intervention and 4 made the ten minutes after intervention. All of Laura's math comments were recorded as positive. Yanni had a cumulative of 2 math comments made during intervention. All of Yanni's math comments were recorded as positive (see Figure 3).

Dyad Two

Dyad Two, Noel and Brad are in the middle panel of the graph for Figures 1 and 2. After three consecutive days of intervention, Brad achieved his slice and was moved onto his next slice (slice changes are indicated by *). For both participants, baseline and intervention performance was variable; however, Noel and Brad both received their highest score during intervention (see Figure 1). For treatment package performance, both Noel and Brad demonstrated variability in their performance with an increasing trend line (see Figure 2). Math comments for Noel and Brad are displayed in Figure 3. During baseline, Noel and Brad both had zero instances of math comments. After being introduced to intervention, Noel had a cumulative of 2 math comments stated during intervention. All of Noel's math statements were recorded as positive. Brad had a cumulative of 2 math comments said during intervention and 2 math comments stated after intervention. All 4 of Brad's math statements were recorded as negative (see Figure 3).

Dyad Three

Dyad Three, Robert and Nathan are in the bottom panel of the graph for Figures 1 and 2. During baseline and intervention for math performance (see Figure 1), Robert's performance remained low until the last two days of intervention. For Nathan in baseline, performance steeply decreased. Once intervention was implemented, there was an initial increase in performance followed by variability in performance scores. For both participants, Nathan and Robert received their highest score during intervention. For treatment package performance during intervention, both Nathan and Robert had an increasing trend in performance (see Figure 2). Nathan demonstrated a sharp increase in performance only after two days of being exposed to the intervention. During baseline for Dyad Three, Robert and Nathan both had zero instances of math comments (see Figure 3). After being introduced to intervention, Robert had a cumulative score of 1 math comment made during intervention. Robert's one math comment was recorded as positive. Nathan had a cumulative of 5 math comments made during intervention. All of Nathan’s math comments were recorded as positive.

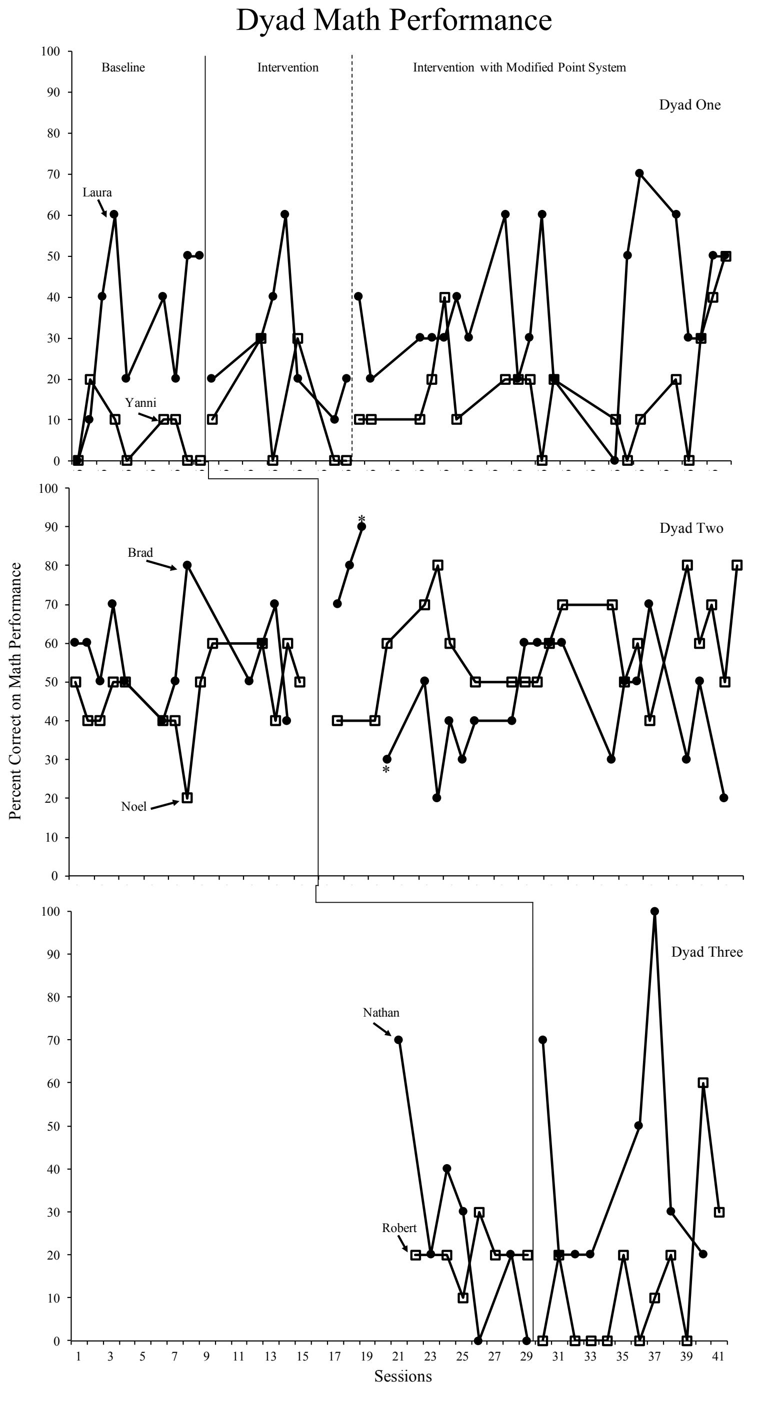

Figure 1. The graph above displays each participant's math performance as percent correct. Slice changes are indicated by *.

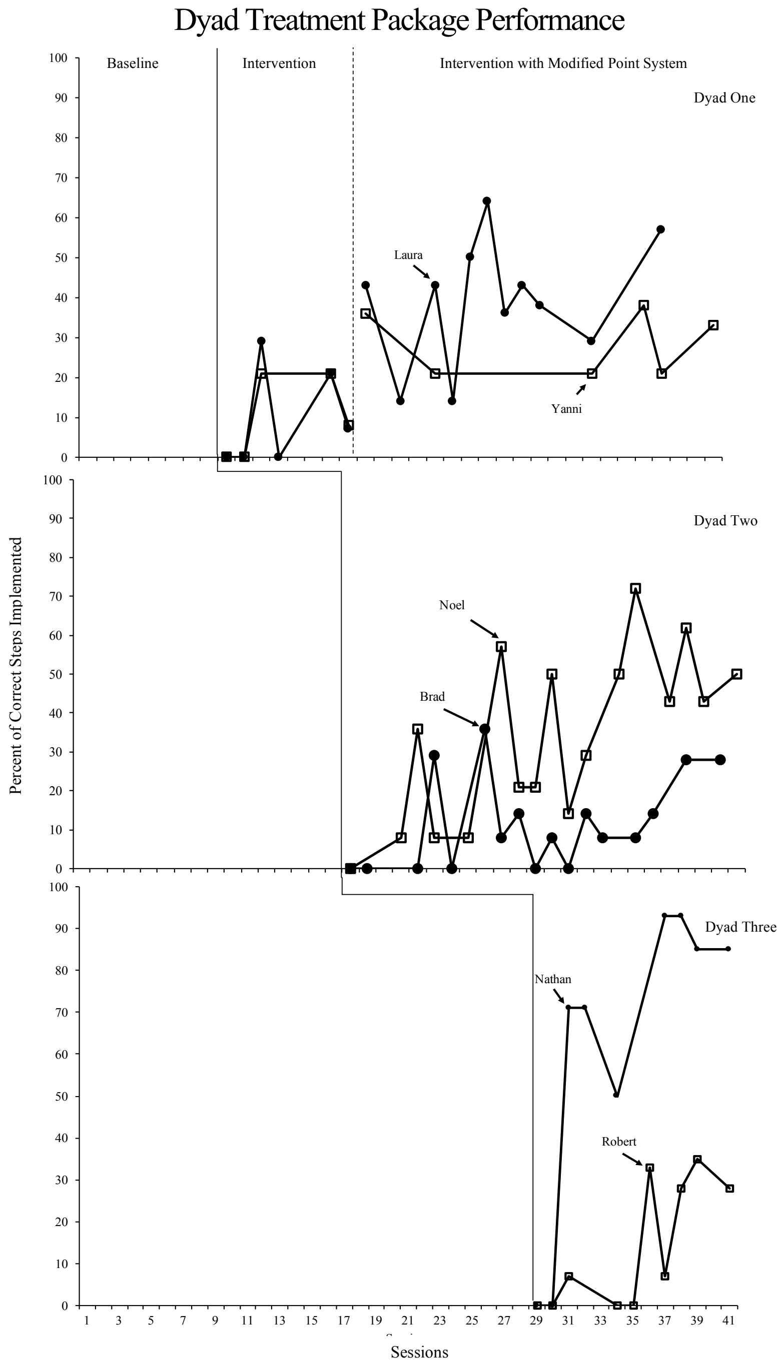

Figure 2. The graph above displays each participant's performance on implementing the peer feedback treatment package as percent correct.

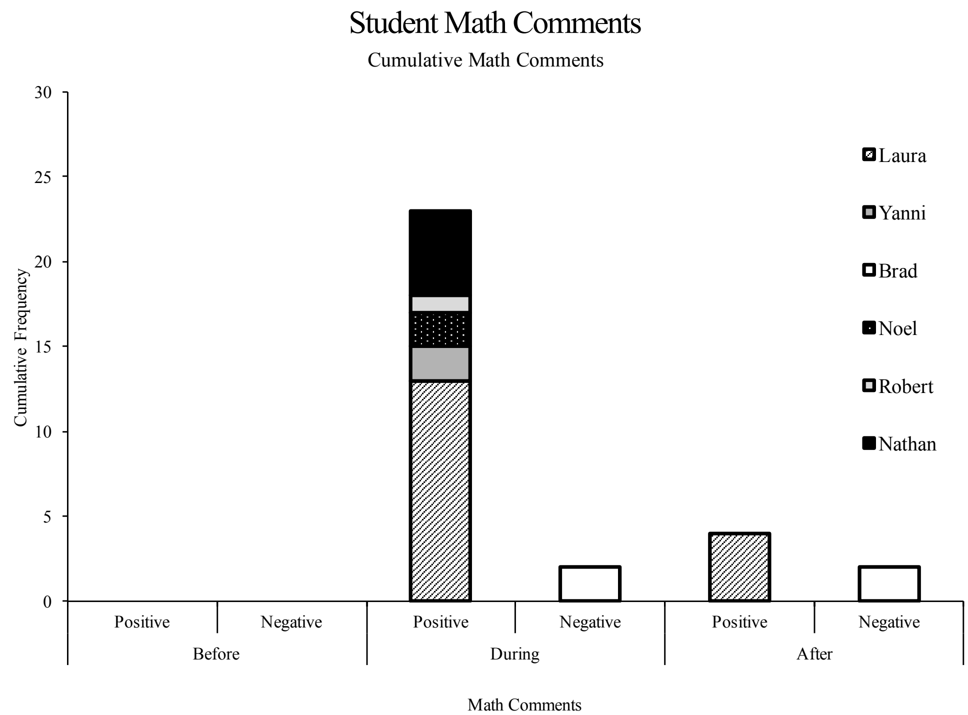

Figure 3. The graph above displays each participant's cumulative number of math comments. Each math comment was recorded as one instance of behavior.

Laura

Laura's math performance in baseline was a mean score of 34%. Laura scored between 10% and 60% on her math worksheets with her lowest score of 10% and her highest at 60%. When Laura was exposed to the intervention, there was an initial increase in percentage of accuracy which was then followed by a drop in performance due to motivation. During intervention, Laura's mean score was 31%. The researchers then exposed Laura to intervention with modified point system in which she could cash in immediately if she beat her score from the following day. During intervention with modified point system, Laura scores were steadily increasing but became variable. During session 35, Laura was denied a preferred activity which triggered an emotional response that carried over into intervention. During session 35, Laura did not respond to intervention and refused to complete the sheet. During intervention with modified point system, Laura's mean score was 37% (range, 0%-70%). Laura scored her highest during intervention with modified point system (70%). For implementing the treatment package, Laura's mean score was 30% (see Figure 2). Laura performed between 0% and 64% during training of the peer feedback package. Laura did not achieve training criterion during intervention. Laura had a cumulative of 14 math comments made during intervention and 4 made the ten minutes after intervention. All of Laura's math comments were recorded as positive (see Figure 3).

Yanni

In baseline, Yanni's mean math performance score was 9% (see Figure 1). Yanni scored between 0% and 20% on her math worksheets with her lowest score of 0% and her highest at 20%. When Yanni was exposed to the intervention, there was an initial increase in percentage of accuracy which was then followed by variability in performance due to a lack of motivation. During intervention, Yanni's mean score was 11%. The researchers then exposed Yanni to a second intervention in which she could cash in immediately if she beat her score from the following day. During intervention with modified point system, Yanni's performance initially increased but dropped and became variable until the last three sessions. During the last session of intervention, it was the last day of school and there was no scheduled independent work time for the class which lead Yanni to be distracted by the other students playing a preferred game. During this day she scored 0%. During intervention with modified point system, Yanni's mean score 17% (range, 0%-50%). Yanni's mean score for treatment package implementation was 25% (see Figure 2). Yanni performed between 0% and 43% during training of the peer feedback package. Yanni did not achieve training criterion during intervention. Yanni had a cumulative of 2 math comments made during intervention. All of Yanni's math comments were recorded as positive (see Figure 3).

Noel

In baseline, Noel's mean math performance score was 45% (see Figure 1). Noel mostly scored between 40% and 50% on her math worksheets with her lowest score of 20% and her highest at 60%. When Noel was exposed to the intervention, there was an initial drop in percentage followed by a short increasing trend and then some variability in scores. Noel's mean score throughout intervention was 59%(range, 40%-80%).Noel's mean treatment package implementation score was 33% (see Figure 2). Noel performed between 0% and 71% during training of the peer feedback package. Noel did not achieve training criterion during intervention. Noel had a cumulative of 2 math comments stated during intervention. All of Noel's math statements were recorded as positive (see Figure 3).

Brad

In baseline, Brad's mean math performance score was 55%. Brad mostly scored between 30% and 70% on his math worksheets with his lowest score of 30% and his highest at 70%. When Brad was exposed to the intervention, there was an increase in percentage of accuracy which allowed Brad to pass his slice and move on to his next slice requirement. In intervention for slice 1, Brad's mean score for worksheet performance was 77%. Once Brad moved onto slice 2, there was a lot of variability in performance. In intervention on slice 2, Brad's mean score was 44% (range, 20%-70%). Brad's mean treatment package implementation score was 11% (see Figure 2). Brad performed between 0% and 35% during training of the peer feedback package. Brad did not achieve training criterion during intervention. Brad had a cumulative of 2 math comments said during intervention and 2 math comments stated after intervention. All 4 of Brad's math statements were recorded as negative (see Figure 3).

Robert

In baseline, Robert's mean math performance score was 20%. Robert scored between 10% and 30% on his math worksheets with his lowest score of 10% and his highest at 30%. When Robert was exposed to the intervention, there was a drop in performance of accuracy. Robert emitted problem behaviors when told that he was to check his own work and the work of his peers. In intervention, Robert's mean score was 14% (range, 0% to 60%). Robert's mean treatment package implementation score was 12% (see Figure 2). Robert performed between 0% and 35% during training of the peer feedback package. Robert did not achieve training criterion during intervention. Robert had a cumulative score of 1 math comment made during intervention. Robert's one math comment was recorded as positive (see Figure 3).

Nathan

In baseline, Nathan mean math performance score was 32%. Nathan scored between 0% and 70% on his math worksheets with his lowest score of 0% and his highest at 70%. When Nathan was exposed to the intervention, there was variability in percentage of accuracy. In intervention, Nathan's mean score throughout intervention was 35% (range, 0%-100%). Nathan's mean treatment package implementation score was 61% (see Figure 2). Nathan performed between 0% and 93% during training of the peer feedback package. Nathan did not achieve training criterion during intervention.

Nathan had a cumulative score of 5 math comments made during intervention. All of Nathan's math comments were recorded as positive.

Social Acceptability

The results of social acceptability are displayed in Appendix I. Social acceptability was measured using a Likert scale (i.e. scale from 1 to 5). The primary researcher individually asked each teacher and student about the intervention from using questions in the social acceptability survey (see appendix I). After each response, the researcher indicated the response from the teacher and student on the survey. Teachers and students had the option to choose from strongly agreeing (i.e. 1) to strongly disagreeing (i.e. 5). All of the participants said they strongly agree (i.e. 1) to liking the peer feedback system; however, an average score of 3.7 (range, 1-5) was provided for "I know my math goal." The teachers' results varied. Teacher for Dyad One provided a rating of 1 for strongly agreeing to liking the peer feedback system and Teacher for Dyad Two and Three provided a rating of 4 which was close to strongly disagreeing to liking the peer feedback system. In addition, Teacher for Dyad Two and Three provided no ranking for question 3 and 4 because she stated she did not watch the system close enough to provide an opinion.

DISCUSSION

A peer feedback treatment package was implemented for three dyads of students with moderate cognitive impairments. The package involved opportunities for the students to score their own work and the work of their partner. Accuracy of checking their individual work allowed each student to gain points towards preferred items. Results suggest that the peer feedback treatment package was effective at increasing math performance for all participants except one. Only a slight increase in performance was demonstrated for overall average math performance for Nathan, Laura, and Yanni. A more robust increase for overall math performance was demonstrated for Noel and Brad. A negative effect was demonstrated for Robert with a decrease in average math performance.

The data were examined beyond what is reported in the results section in an effort to determine if any outside variables may have impacted each student's performance during the classroom sessions or if any particular worksheets were associated with a student performing at a higher score compared to the other worksheets. The researcher did not find any association between specific worksheets and respective performance. Additionally, one session was conducted per day with the opportunity to exchange points accumulated throughout the week on Fridays for Dyad Two and Three (daily for Dyad One when they entered the Modified Point System phase). The researcher did not find any association between performance for each student on their individual math worksheets and when the students were able to exchange their points for preferred items.

One interesting finding is how motivation to complete the worksheet accurately and exchange earned points at the end of the week did not appear to be motivating enough for Dyad One and that both students required earning access to some preferred stimulus more immediately. The researcher hypothesized this to be the case due to the students' performance during intervention compared to earlier sessions. For example, during earlier sessions, Laura would count out loud when doing her worksheets. Later, during intervention, Laura would write the number "10" or "11" for every answer and would no longer count out loud. In addition, during intervention Dyad One's scores did not progress and the students began exhibiting behaviors that may have been indicative of lack of motivation (e.g. scribbling on the paper or writing "11" for every answer). Both students in Dyad One began to progress in their math scores once intervention with modified point system was introduced. Since each student had five different worksheets and answers keys, it is unlikely that the progress was due to practice effects and remembering the correct answer. This finding is consistent with Knapczyk and Livingston (1973) in which a self-recording and academic scores are higher when paired with a token economy.

Another interesting finding was that none of the dyads passed the training criterion to allow researchers to end training (and providing prompting) the participants. Training was never discontinued because no student met mastery for two consecutive days. The most critical steps that all students consistently needed additional prompting with was the task for grading their own work and the work of their partner. In addition, Brad, Noel and Yanni had difficulty with fine motor tasks and would often require assistance holding a pencil. These finding are very critical to educators who are considering the use of the peer feedback package in the classroom due to the time and resources that may be required to implement such an intervention successfully. Teachers may find the peer feedback package to be too time consuming to implement or take too much training up front for long term pay off (e.g. students grading their own work). Further research should focus on analyzing the individual components of the peer feedback treatment package to determine if all of the pieces of the treatment package are needed to gain an initial effect and achieve sustained outcomes. Future research should replicate the peer feedback package with other students with moderate cognitive impairment to see if similar results are achieved. Replicating these findings would provide more strength to the treatment package and allow for further identification of steps within the package that may be more critical and influential to students with moderate cognitive impairments. Additional research could also investigate ways to include students in grading their own work and monitoring their own progress. Teaching students these skills will allow them to track and monitor their own performance in an academic content area such as mathematics, but it may also aid teachers with the task of tracking performance by decreasing the workload and demand on their skills. Additionally, developing students' skills in these areas may have the capacity to generalize to other academic skill content areas or other life skills (Holifield, Goodman, Hazelkorn, & Heflin, 2010).

The current data does not provide clear support for use of the peer feedback treatment package as a sole intervention for increasing academic success. Students did not progress rapidly and only one student met his slice (i.e. Brad). In addition, not one student met mastery criterion for implementing the intervention on an independent basis. Most prompting for students was needed during times when they were grading their own work and the work of their partner. Although the intervention did increase math performance for five participants, future research should examine if greater and quicker effects could be achieved when pairing the peer feedback package with an empirically supported curriculum and delivery of instruction. When providing students with worksheets and independent work, it is important that the work is matched with the instruction provided. The worksheets made for the current investigation look similar to a math curriculum delivered by the teachers in the research setting; however, no data were collected to determine if the initial and ongoing math instruction was delivered effectively. Additionally, no data were collected in the context of the study to determine if the actual curriculum that was being used by the teachers had any data to support its instructional design (e.g. scope, sequence, examples, non-examples).

The current investigation chose to examine the effects of the peer feedback treatment package on math performance for a few reasons. First, the content area of math was selected because both classrooms had independent daily work time devoted to math skills. This allowed the researcher to add the intervention to the classroom without changing the students schedule too much. Second, completing math independent work typically involves the students writing down one correct answer that can easily be compared to an answer key without any other training or skill. For example, comparing the number 9 to 9 is a simpler task than identifying if a word was pronounced correctly. Future investigations should use the peer feedback system with other content areas to identify if it is affective with other content or learning channels (e.g. see/say, say/write).

Future research should also investigate groupings of students and whether heterogeneous or homogenous dyads can impact students' performance on their academic tasks. During the current investigation, Dyad Two was the closest in skill level and they also had the most robust effects when the peer feedback intervention was implemented. This finding is interesting because it may be that homogenously grouping the students will affect how well they perform on their math skills. In addition, the students may be better able to grade each other's work if the students are on similar performance levels. For example, Yanni always needed additional prompting when grading Laura's work. Even though she was able to match to sample, she was still working on the skill of identifying numbers. Future research should investigate ways to allow for successful heterogeneous grouping if homogenous grouping is not an option in the classroom. For example, using adaptive technology to allow a lower performer to grade and provide feedback to a higher performer (Skylar, 2007).

Future research should further identify prerequisite skills that may be required to effectively use the peer feedback package in addition (or perhaps in place of) the ability to match to sample and exchange of short phrases and sentences. Throughout the implementation of the current investigation, it was discovered that some students did not know how to properly hold a pencil or identify symbols used in a math equation. For example, Brad, Noel and Yanni would often need additional assistance writing in their slice criterion or circling the amount of points earned for that day. All of the participants except Nathan had to learn what the symbols "+" and "-" represented. Only Nathan and Laura, near the end of the study, could independently write a "+" or "-" for correct or incorrect work. These were not skills that were originally tested for and were presumed to be present for all participants given the referral information that was provided by the teachers. Future research should examine further if there are other prerequisite skills that may be necessary for students to be successful with a peer feedback package.

Additionally, it may be beneficial to examine whether modifications to the system could be made that would allow quicker acquisition of the steps necessary to engage in the intervention without the ongoing assistance of a researcher (or others).

Although the current investigation found some interesting findings and avenues for future research some limitations should be considered. First, it should be noted that that while the present study did focus on the math performance of the students the actual instruction that was implemented by the teachers was not something that was under the control of the researcher. Both teachers used a variety of curricula to teach each student math including *Connecting Math Concepts*®, *Touch Math*©, *Math Essential Elements*©, and using a number line. For all students, it was discovered through the initial IEP goal testing phase that the teacher written objectives were not appropriate for each student's present level of performance and new objectives had to be written. Due to the lack of control during instruction, this may have influenced some of the variability in the data collected and may have also influenced some of the behaviors that were demonstrated by the participants. For example, Nathan was observed using a classroom calendar as a number line during the first baseline session. On two occasions during intervention, Nathan was observed slightly opening his binder to view the answer key. It is hypothesized some of Nathan's highest scores may be due to viewing the correct answers on his answer key in his binder. This behavior may be due to the fact that some of the material was at what is referred to as frustration level rather than an appropriate instructional level for instruction (Skinner, Pappas, & Davis, 2005). Also the addition of the incentive point system may have influenced cheating behaviors, especially if the student was not consistently meeting his or her goal to gain the most preferred prize.

Future research should investigate ways to prevent cheating by placing contingencies on other behaviors rather than just accuracy. For example, future studies may want to provide points to students based on how they are performing the task (e.g. counting aloud) or if they complete certain steps while solving a problem (e.g. lining up the numbers correctly for addition problems).

Another limitation to the study is the lack of control in the classroom environment. Often the teachers would end independent work time early or another student in the classroom would engage in a target behavior that would create a distraction to the participants. This may have also reduced motivation to complete the worksheet accurately.

A final limitation to the study is the amount of time it took to train each dyad. None of the dyads made it out of the training phase for intervention. Future research should identify ways to scale back the amount of steps within the intervention to still make it effective. Important steps within the treatment package that are most critical and should be included are the steps of having the students correctly grade the work and the step of identifying whether or not they made their goal. These pieces are most important because it involves teaching the student to identify whether or not their response was correct and if they are making progress towards their goal. One possible step that may be able to be eliminated is the step of writing the number correct at the top of the worksheet. In the current investigation, the student wrote the number correct at the top of the worksheet and circled whether or not the slice criteria was achieved. Future research could investigate combining the two steps into one step. Other steps that may be eliminated could include the steps of tracking whether the students pulled out relevant materials (i.e. worksheet, self-score form, answer key). Future investigations may want to include an automated system of having all materials ready for students prior to the beginning of intervention so they do not have to retrieve the materials. In addition, future research should consider students' history when implementing the peer feedback system. For example, Robert had problem behavior in the form of pulling away his worksheet and refusing to allow the researcher to prompt him through grading his work. This occurred only when he was required to check his own work and the work of his peers. Future research may want to consider having a student, like Robert, grade his own work before being paired with another student. The additional step of having the student grade his own work independently may allow the student to contact the consequence of earning prizes within the store for being accurate with scoring their own work and before having another peer check the work for accuracy. Identification of a student's history could be done during the IEP probe testing where the researcher could serve as a peer to determine if the student has any problem behaviors when asked to grade his own work or the work of the researcher.

In conclusion, the peer feedback treatment package did not reliably increase math scores for students with moderate cognitive impairments; however, some very interesting findings were identified along the way. If the peer feedback system was to be recommended to a colleague or teacher, there are a few recommendations to consider. First, a commitment from the teacher is necessary, not only initially but also on an ongoing basis to support the peer feedback treatment package. Additionally, a curriculum based on previous research and empirically validated sources is critical. The teacher must be prepared to adhere to a curriculum. Second, the delivery or implementation of the curriculum must stay consistent before and during the introduction of the peer feedback treatment package. This consistency will allow for the teacher to truly evaluate the affects of the package and may help reduce some of the variability which were demonstrated in the graphs above. Lastly, establishing an "intervention timeline" that includes projected dates for which the students should meet a slice or criterion would be helpful. If the student did not meet the slice within this established timeframe, the teacher and student should meet to discuss ways to help the student increase their math score and alter the intervention as needed (e.g., counting out loud, using a facts family timesheet, or fluency drills with picking up a pencil). This would help to facilitate progress and success in achieving overall objectives.

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Appendix A

Self-score Form

Schedule	Monday			Tuesday			Wednesday			Thursday			Friday		
Slice															
Math Facts	+ –	+ –	2 1 0	+ –	+ –	2 1 0	+ –	+ –	2 1 0	+ –	+ –	2 1 0	+ –	+ –	2 1 0
Total Points															

If you made your daily goal place a "+" sign for that day. If not, place a "-"sign.

Remember: accurately recording your school work progress will earn you points! You can turn in your points at the end of the week for the classroom store!

Annual Goal: Student will solve 45 addition problems in 1 minute.

Slices	Criteria
Slice 1	10 Problems correct
Slice 2	15 Problems correct
Slice 3	20 Problems correct
Slice 4	25 Problems correct
Slice 5	30 Problems correct
Slice 6	35 Problems correct
Slice 7	40 Problems correct
Slice 8	45 Problems correct

Appendix B

Task Analysis Datasheets

Self- Score and Evaluate Task Analysis Checklist	**Scorer:** **Student:**	**Date :**
Steps	**+/-**	**Notes**
1. Student picks up self-score form	+ -	
2. Student writes phase criteria in box	+ -	
3. Student grabs correct answer key	+ -	
4. Student places a "+" or "-" mark next to each correct or incorrect completed problem	+ -	
5. Student writes number of "+" at bottom of worksheet	+ -	
6. Student circles "+" or "-" on self-score form	+ -	
7. Student switches all materials with other student (e.g. worksheet, answer key, and self-score form)	+ -	
Total	**/7 *100=**	

Check Task Analysis Checklist	Scorer: Student:	Date :
Steps	**+/-**	**Notes**
1. Student picks up switched materials	+ -	
2. Student points to phase change criteria	+ -	
3. Student places a "+" or "-" mark next to each correct or incorrect completed problem	+ -	
4. Student writes number of "+" at bottom of worksheet	+ -	
5. Student circles "+" or "-" on self-score form	+ -	
6. Student circles 2 for "+/+" 1 for "-/-" or 0 for "+/-"	+ -	
7. Student switches all materials with peer checker (e.g. worksheet, answer key, and self-score form)	+ -	
Total	**/7 *100=**	

Appendix C

Accuracy of Completed Problems Datasheet

Number of Correct Problems **Student:** **Scorer:** **Annual Goal:**		
Date	**Number of Correct Problems**	**Met Phase Criteria?**

Appendix D

Self-score and Evaluate Lesson Plan

Self-score and Evaluate Training

Objectives

Student will:

1. Locate self-score form
2. Write phase criteria in box on self-score form
3. Locate correct answer key
4. Place a "+" or "-" mark next to each completed problem
5. Write number of "+" problems at bottom of worksheet
6. Circle "+" or "-" on self-score form
7. Switch all materials with other student (e.g. worksheet, answer key, and self-score form)

Instructions

At least one student pair will be randomly selected to receive peer feedback component training after baseline. Students will be taught using explicit instruction (e.g. a model, lead, test procedure).

Step 1

Researcher will be seated facing the student. The researcher will provide the student with the worksheet. Prior to beginning the worksheet, the researcher will model for the student where to find the self-score sheet and where to locate the phase criteria. All self-score sheets will be located in each student's desk in a blue folder. Each phase criteria will be located on the back of the self-score sheet.

Step 2

The researcher will then model writing the phase criteria in a box located on the self-score form for that day. The researcher will flip over the self-score sheet locate the phase criteria that has not yet been completed and write the criteria on the front of the self-score form under the correct date.

Step 3

After 15 minutes or after the student has indicated they are finished with their worksheet, the researcher then models grabbing the answer key. All answer keys will have a letter (e.g. A, B, C, etc.) located on the top of the sheet. These letters will match the student worksheets. Answers keys will be folder in a blue folder on the teacher's desk.

Step 4

The researcher will model going through each problem and stating aloud whether the answer was a match. If the worksheet answer matched the answer key, the researcher would place a "+" next to the problem. After going through each problem, the researcher then will model counting up each "+" mark.

Step 5

The researcher then models putting the total number of "+" marks at the end of the worksheet (e.g. writing 5 at the bottom of the sheet).

Step 6

After totaling the number of correct answers, the researcher will model matching the number correct to the phase criteria number written on the self-score form . If the number is at or above the phase criteria, the student will circle a "+" mark in the allotted space. If the number is below phase criteria, the student will circle a "-"mark in the allotted space.

Step 7

After completing the self-score form, the student will wait until a vocal signal is provided from the researcher that it is time to switch materials with the other student in the pair. The student would then switch materials with the other student in the pair. Switched materials will include: worksheet, self-score form and answer key. Training sessions will be discontinued once both students complete peer feedback component training with 100% accuracy for two consecutive sessions. Students will be trained on all tasks during each training session.

Appendix E

Treatment Fidelity Datasheet

Self-score and Evaluate Training Treatment Fidelity Data sheet		
Scorer:	**Date:**	**Researcher:**
1. Researcher provides student with worksheet.	+ -	
2. Researcher shows student where to find self-score sheet	+ -	
3. Researcher shows student where to find phase criteria	+ -	
4. Researcher models writing in phase criteria	+ -	
5. Researcher models grabbing the answer key	+ -	
6. Researcher models listing each problem as a match aloud and writes a "+" or "-" next to each problem	+ -	
7. Researcher models putting the total number of "+" marks at the bottom of the worksheet	+ -	
8. Researcher models comparing the total number of "+" marks to the phase criteria	+ -	
9. Researcher models circling the correct sign (+/-)	+ -	
10. Researcher models waiting for the vocal signal to exchange	+ -	

switched materials		
Total	**/10*100=**	

Appendix F

Check Training Lesson Plan

Check Component Training

Objectives

Students will:

1. **Picks up switched materials**
2. **Points to phase change criteria**
3. **Places a “+” or “-“ mark next to each completed problem**
4. **Write number of “+” at bottom of worksheet**
5. **Circles “+” or “-“ on self-score form**
6. **Circles 2 for “+/+” 1 for “-/-“ or 0 for “+/-“**
7. **Switch all materials with other student (e.g. worksheet, answer key, and self-score form)**

Instructions

Student pair will receive self-score, evaluate and check component training immediately after baseline. Students will be taught using explicit instruction (e.g. a model, lead, test procedure).

Step 1

The researcher will be seated facing the student. The researcher would then model for the student how to receive the switched materials (e.g. grabbing all needed self-score forms from other student).

Step 2

The researcher models for the student where to find the phase criteria for the other paired student.

Step 3

Once the phase criteria has been located, the will then model for the student how to compare the worksheet answers with the answer key. The researcher will model placing a "+" mark next to the matched problems and a "-"next to the problems that did not match the answer key.

Step 4

The researcher will model adding up all of the "+" marks and write the total on the bottom of the worksheet.

Step 5

If the student is at or above phase criteria, the researcher will demonstrate circling a "+" mark next to the students previous marked sign.

Step 6

The researcher will model circling the score for the day. If the both students circled the "+" mark, the researcher will model circling the "2". If both students circled the "-"mark, the researcher will model circling the "1". If one student circled a "+" mark and the other a "-"mark, the researcher will model circling the "0".

Step 7

The researcher will model waiting for the vocal signal and handing all the documents back to the student. The researcher will then instruct the students to look over the self-score form . Training sessions will be discontinued once students complete peer feedback component training with 100% accuracy for 2 consecutive sessions. Students will be trained on all tasks during each training session.

Appendix G

Check Training Treatment Fidelity Datasheet

Check Training Treatment Fidelity Data sheet		
Scorer:	**Date:**	**Researcher:**
1. Researcher models receiving switched materials	+ -	
2. Researcher shows student where to find phase criteria	+ -	
3. Researcher models listing each problem as a match aloud and writes a "+" or "-" next to each problem	+ -	
4. Researcher models putting the total number of "+" marks at the bottom of the worksheet	+ -	
5. Researcher models comparing the total number of "+" marks to the phase criteria	+ -	
6. Researcher models circling the correct sign (+/-)	+ -	
7. Researcher models circling a "2" for (+/+), "1" for (-/-) and "0" for (+/-)	+ -	
8. Researcher models waiting for the vocal signal to exchange switched materials	+ -	
9. Researcher models giving back switched materials	+ -	
Total	**/9*100=**	

Appendix H

Noel's Worksheets

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Student: 7001 Date: ________________ WKST: A-1

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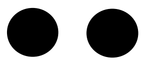
1.  = $\boxed{2}$ $\boxed{1}$ $\boxed{3}$

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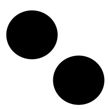
2.  = $\boxed{3}$ $\boxed{1}$ $\boxed{2}$

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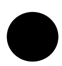
3.  = $\boxed{1}$ $\boxed{3}$ $\boxed{2}$

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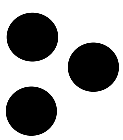
4.  = $\boxed{2}$ $\boxed{3}$ $\boxed{1}$

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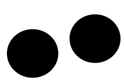
5.  = $\boxed{3}$ $\boxed{2}$ $\boxed{1}$

6. ● ● ● $= \boxed{3}\ \boxed{2}\ \boxed{1}$

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7. ● $= \boxed{1}\ \boxed{2}\ \boxed{3}$

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8. ● ● $= \boxed{3}\ \boxed{2}\ \boxed{1}$

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9. ● $= \boxed{2}\ \boxed{1}\ \boxed{3}$

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10. ● ● ● $= \boxed{1}\ \boxed{2}\ \boxed{3}$

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: __________________ WKST: A-2

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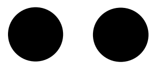
1.  = $\boxed{1}$ $\boxed{2}$ $\boxed{3}$

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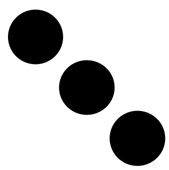
2.  = $\boxed{3}$ $\boxed{1}$ $\boxed{2}$

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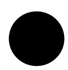
3.  = $\boxed{2}$ $\boxed{3}$ $\boxed{1}$

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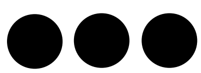
4.  = $\boxed{2}$ $\boxed{3}$ $\boxed{1}$

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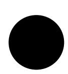
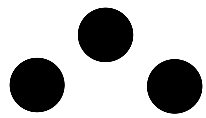
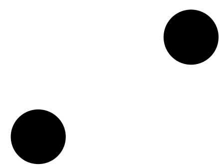
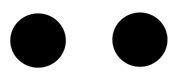
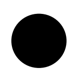
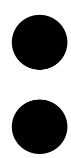
5.  = $\boxed{3}$ $\boxed{2}$ $\boxed{1}$

6.  = $\boxed{3}$ $\boxed{2}$ $\boxed{1}$

7.  = $\boxed{1}$ $\boxed{2}$ $\boxed{3}$

8.  = $\boxed{3}$ $\boxed{2}$ $\boxed{1}$

9.  = $\boxed{2}$ $\boxed{1}$ $\boxed{3}$

10.  = $\boxed{1}$ $\boxed{2}$ $\boxed{3}$

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: __________________ WKST: A-3

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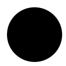
1.  = 1 2 3

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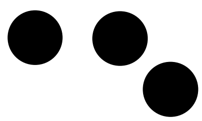
2.  = 3 1 2

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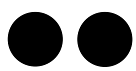
3.  = 1 3 2

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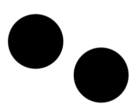
4.  = 3 2 1

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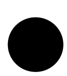
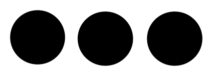
5.  = 3 2 1

6.  = 1 2 3

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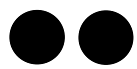
7.  = 2 3 1

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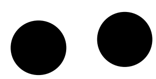
8.  = 1 2 3

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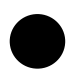
9.  = 2 1 3

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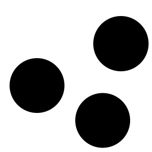
10.  = 1 3 2

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ___________________ WKST: A-4

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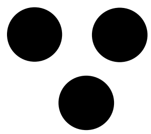
1.  = 1 2 3

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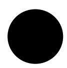
2.  = 3 1 2

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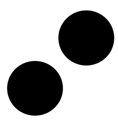
3.  = 2 3 1

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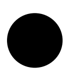
4.  = 2 3 1

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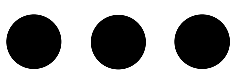
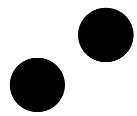
5.  = 3 2 1

6.  = 3 2 1

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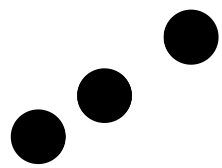
7.  = 1 2 3

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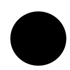
8.  = 3 2 1

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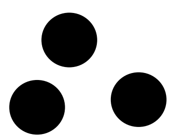
9.  = 2 1 3

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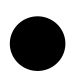
10.  = 1 2 3

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ___________________ WKST: A-5

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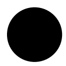
1.  = $\boxed{2}$ $\boxed{1}$ $\boxed{3}$

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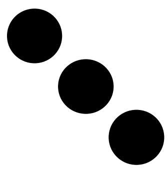
2.  = $\boxed{3}$ $\boxed{1}$ $\boxed{2}$

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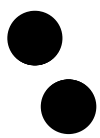
3.  = $\boxed{2}$ $\boxed{3}$ $\boxed{1}$

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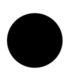
4.  = $\boxed{2}$ $\boxed{3}$ $\boxed{1}$

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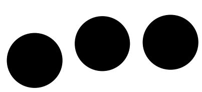
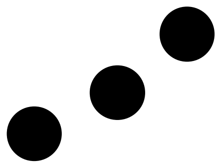
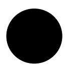
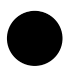
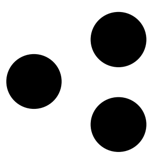
5.  = $\boxed{3}$ $\boxed{2}$ $\boxed{1}$

6.  = 3 2 1

7.  = 1 2 3

8.  = 3 2 1

9.  = 2 1 3

10.  = 1 2 3

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A1

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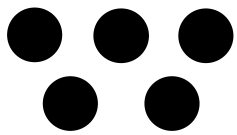
1.  = 4 3 5

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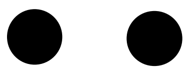
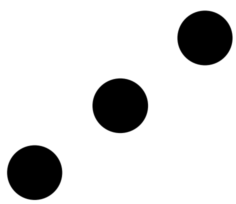
2.  = 2 1 3

---

3.  = 1 3 2

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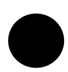
4.  = 1 3 5

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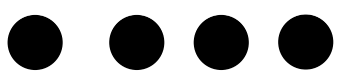
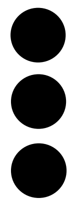
5.  = 5 4 2

6.  = | 2 | 3 | 5 |

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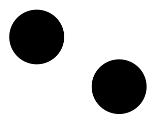
7.  = | 1 | 5 | 2 |

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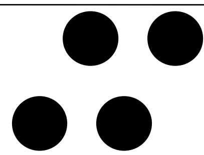
8.  = | 4 | 3 | 5 |

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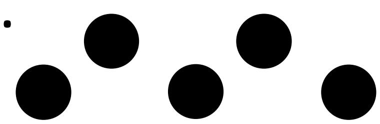
9.  = | 5 | 4 | 2 |

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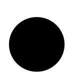
10.  = | 3 | 1 | 2 |

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A2

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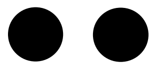
1.  = $\boxed{1}$ $\boxed{2}$ $\boxed{3}$

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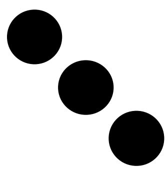
2.  = $\boxed{3}$ $\boxed{5}$ $\boxed{2}$

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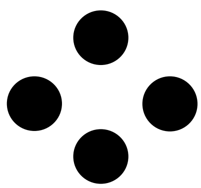
3.  = $\boxed{2}$ $\boxed{4}$ $\boxed{1}$

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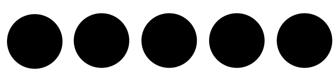
4.  = $\boxed{5}$ $\boxed{3}$ $\boxed{4}$

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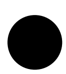
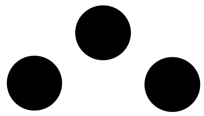
5.  = $\boxed{4}$ $\boxed{2}$ $\boxed{1}$

6.  = $\boxed{3}$ $\boxed{2}$ $\boxed{5}$

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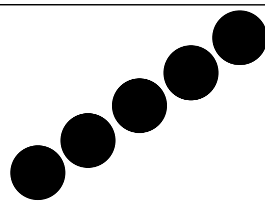
7.  = $\boxed{5}$ $\boxed{4}$ $\boxed{3}$

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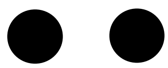
8.  = $\boxed{3}$ $\boxed{2}$ $\boxed{1}$

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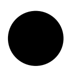
9.  = $\boxed{2}$ $\boxed{1}$ $\boxed{4}$

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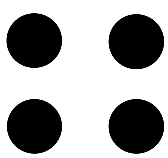
10.  = $\boxed{4}$ $\boxed{2}$ $\boxed{3}$

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A3

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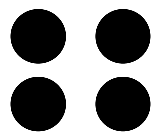
1.  = $\boxed{5}$ $\boxed{3}$ $\boxed{4}$

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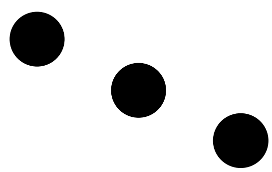
2.  = $\boxed{3}$ $\boxed{1}$ $\boxed{4}$

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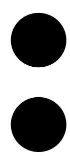
3.  = $\boxed{3}$ $\boxed{2}$ $\boxed{1}$

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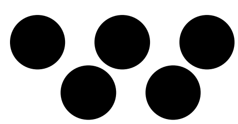
4.  = $\boxed{4}$ $\boxed{5}$ $\boxed{2}$

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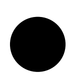
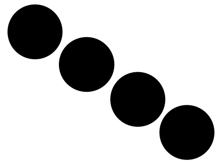
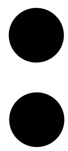
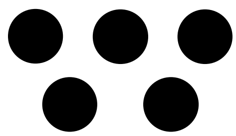
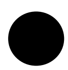
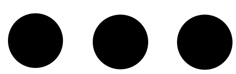
5.  = $\boxed{5}$ $\boxed{3}$ $\boxed{1}$

6.  = $\boxed{3}$ $\boxed{5}$ $\boxed{4}$

7.  = $\boxed{2}$ $\boxed{3}$ $\boxed{5}$

8.  = $\boxed{2}$ $\boxed{5}$ $\boxed{4}$

9.  = $\boxed{2}$ $\boxed{3}$ $\boxed{1}$

10.  = $\boxed{3}$ $\boxed{4}$ $\boxed{5}$

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ____________________ WKST: A4

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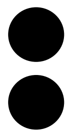
1.  = 2 | 1 | 4

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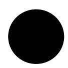
2.  = 5 | 3 | 1

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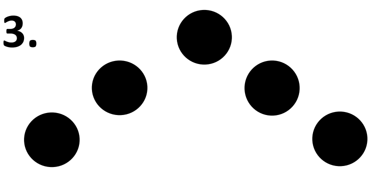
3.  = 3 | 4 | 5

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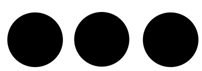
4.  = 3 | 1 | 2

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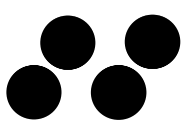
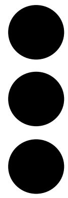
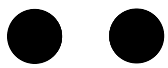
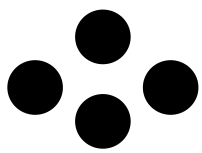
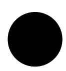
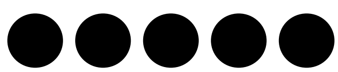
5.  = 2 | 4 | 5

6.  = | 3 | 1 | 2 |

7.  = | 1 | 2 | 4 |

8.  = | 5 | 3 | 4 |

9.  = | 3 | 1 | 5 |

10.  = | 5 | 3 | 4 |

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A5

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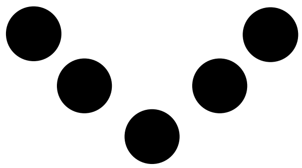
1. 

= 4 5 3

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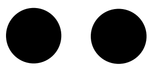
2. 

= 1 4 2

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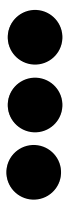
3. 

= 3 1 5

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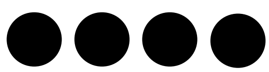
4. 

= 1 4 3

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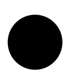
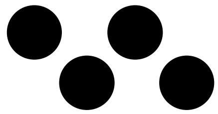
5. 

= 5 1 4

6.  = 4 3 2

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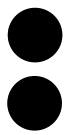
7.  = 4 2 5

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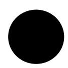
8.  = 1 3 4

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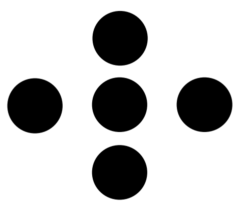
9.  = 3 5 2

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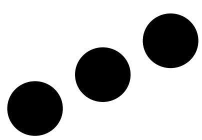
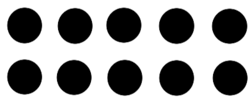
10.  = 1 2 3

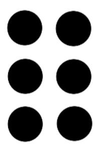
Curriculum-Based Assessment Mathematics

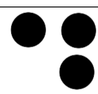
Single-Skill Computation Probe: Student Copy

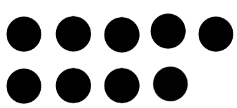
Date: ______________________ WKST: B-1

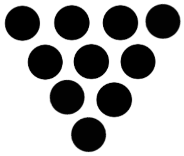
1.  = 4 10 6

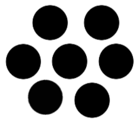
2.  = 3 7 1

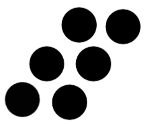
3.  = 4 8 6

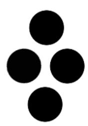
4.  = 3 10 5

5.  = 9 2 10

6.  = | 8 | 3 | 10 |

7.  = | 9 | 7 | 2 |

8.  = | 5 | 8 | 6 |

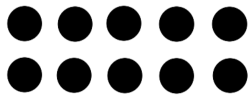
9.  = | 4 | 7 | 2 |

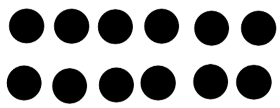
10.  = | 1 | 2 | 6 |

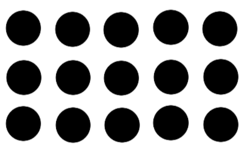
Curriculum-Based Assessment Mathematics

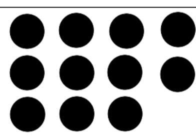
Single-Skill Computation Probe: Student Copy

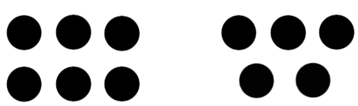
Date: ______________________ WKST: A1

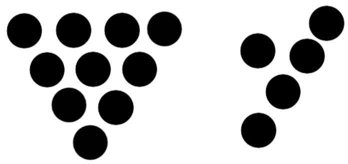
1.  = ___________

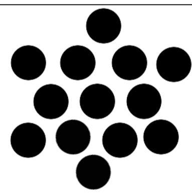
2.  = _____________

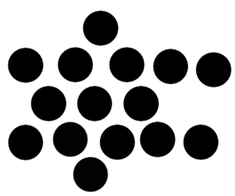
3.  = _____________

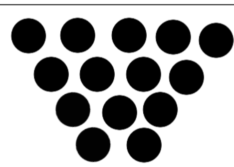
4.  = _____________

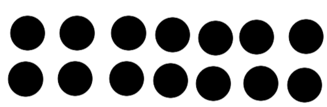
5.  = _____________

6.  = ____________

7.  = ____________

8.  = ____________

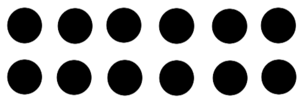
9.  = ____________

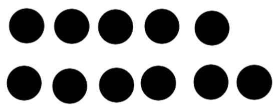
10.  = ____________

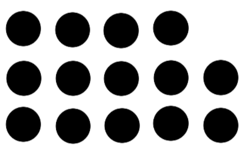
Curriculum-Based Assessment Mathematics

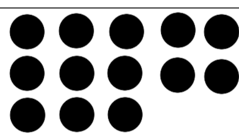
Single-Skill Computation Probe: Student Copy

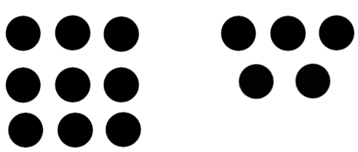
Date: ______________________ WKST: A2

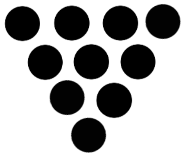
1.  = ____________

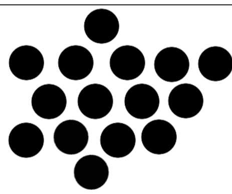
2.  = ____________

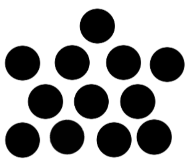
3.  = ____________

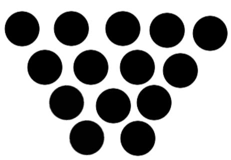
4.  = ____________

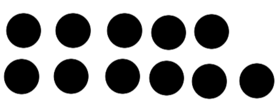
5.  = ____________

6.  = ____________

7.  = ____________

8.  = ____________

9.  = ____________

10.  = ____________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ____________________ WKST: A3

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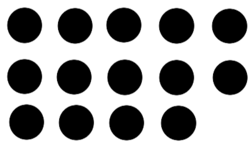
1.  = ____________

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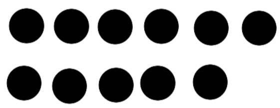
2.  = ____________

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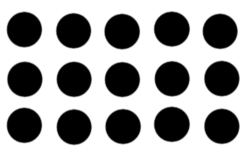
3.  = ____________

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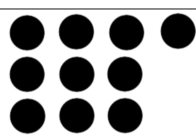
4.  = ____________

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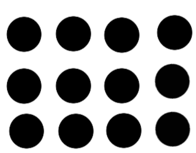
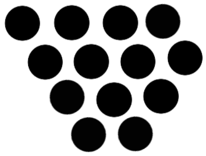
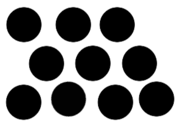
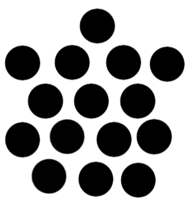
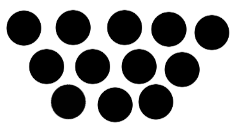
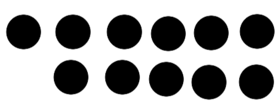
5.  = ____________

6.  = ____________

7.  = ____________

8.  = ____________

9.  = ____________

10.  = ____________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A4

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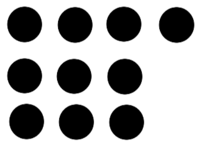
1.  = ____________

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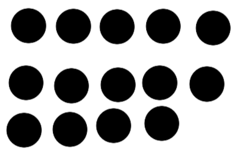
2.  = _____________

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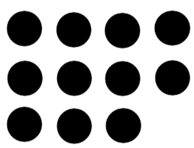
3.  = _____________

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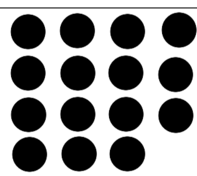
4.  = ______________

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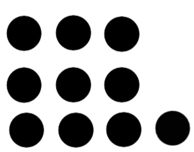
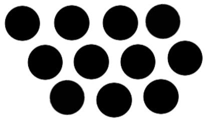
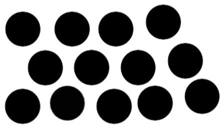
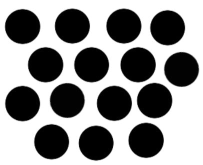
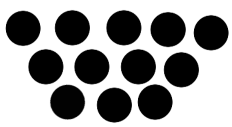
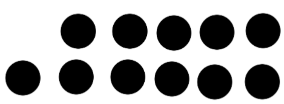
5.  = ______________

6.  = ____________

7.  = ____________

8.  = ____________

9.  = ____________

10.  = ____________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A5

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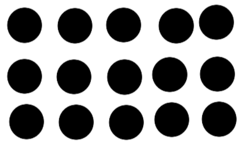
1.  = ____________

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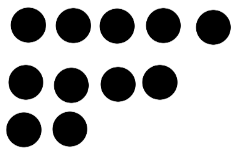
2.  = ____________

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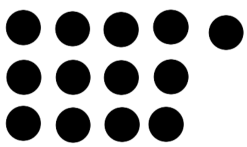
3.  = ____________

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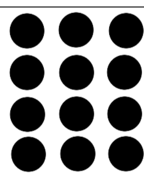
4.  = ____________

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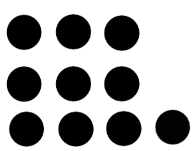
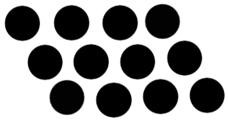
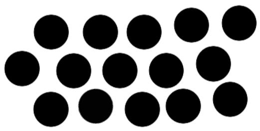
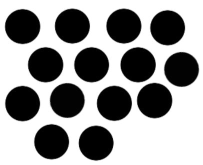
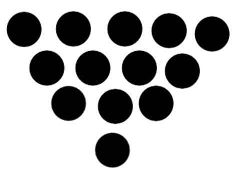
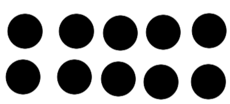
5.  = ____________

6.  = ______________

7.  = ______________

8.  = ______________

9.  = ______________

10.  = ______________

Curriculum-Based Assessment Mathematics

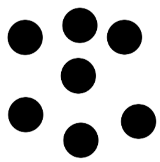
Date: ______________________ WKST: A1

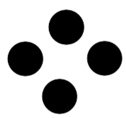
Robert's Worksheets

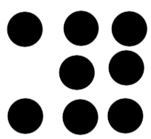
Curriculum-Based Assessment Mathematics

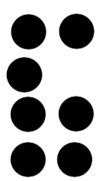
Single-Skill Computation Probe: Student Copy

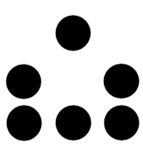
Date: ______________________ WKST: A-1

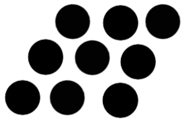
1.  = ____________________

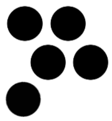
2.  = ____________________

3.  = ____________________

4.  = ____________________

5.  = ____________________

6.  = ________________

7.  = ________________

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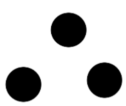
9.  = ________________

10.  = ________________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A-2

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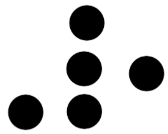
1.  = ____________________

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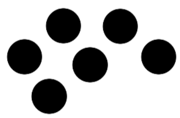
2.  = ____________________

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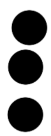
3.  = ____________________

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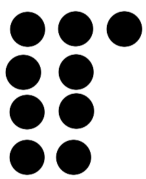
4.  = ____________________

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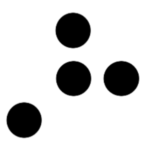
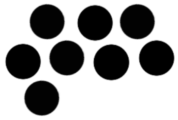
5.  = ____________________

6.  = ______________

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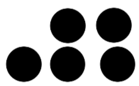
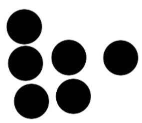
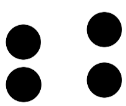
8.  = ______________

9.  = ______________

10.  = ______________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A-3

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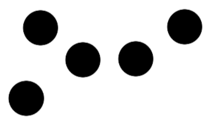
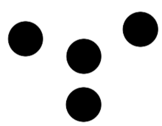
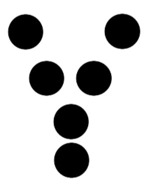
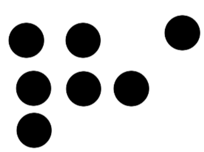
2.  = ____________________

3.  = ____________________

4.  = ____________________

5.  = ____________________

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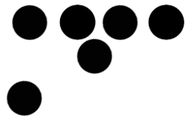

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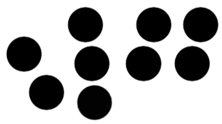

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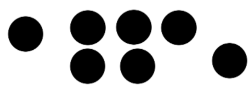
8.



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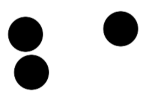

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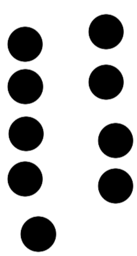

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Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A-4

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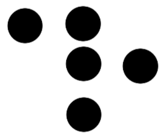
1.  = ____________________

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2.  = ____________________

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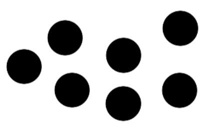
3.  = ____________________

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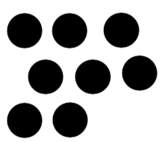
4.  = ____________________

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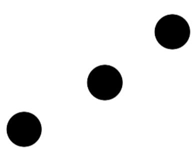
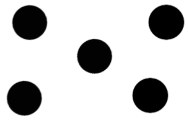
5.  = ____________________

6.  **=** ________________

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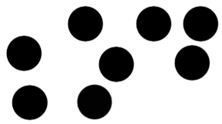
7.  **=** ________________

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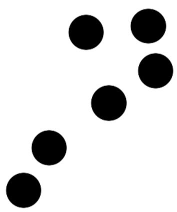
8.  **=** ________________

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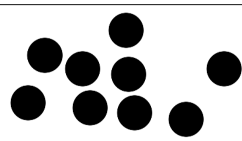
9.  **=** ________________

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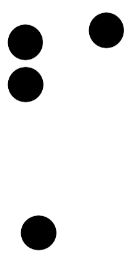
10.  **=** ________________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A-5

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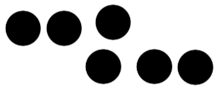
1.  = ____________________

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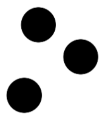
2.  = ____________________

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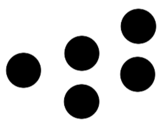
3.  = ____________________

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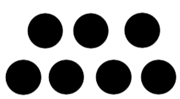
4.  = ____________________

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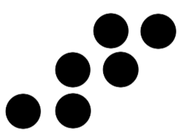
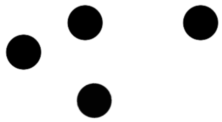
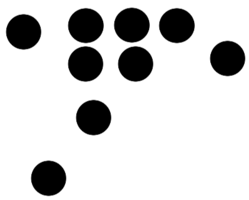
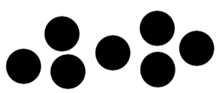
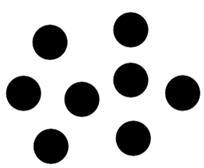
5.  = ____________________

6.  = ______________

7.  = ______________

8.  = ______________

9.  = ______________

10.  = ______________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A1

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1. 14 + 6 – 8 =__________

2. 7 + 12 – 4 =__________

3. 11 + 2 – 3 =__________

4. 5 + 12 – 5 =__________

5. 16 + 4 – 0 =__________

6. 20 + 8 – 9 =__________

7. 14 + 9 – 3 =__________

8. 10 + 6 – 1 =__________

9. 19 + 0 – 6 =__________

10. 10 + 12 – 2 =_________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A3

1. 14 – 2 + 3 =__________

2. 3 + 16 – 9 =__________

3. 13 + 8 – 5 =__________

4. 1 + 16 – 8 =__________

5. 19 + 7 – 6 =__________

6. 20 + 8 – 9 =__________

7. 11 + 12 – 7 =__________

8. 10 + 3 – 4 =__________

9. 19 + 0 – 9 =__________

10. 10 + 3 – 2 =_________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A4

1. 20 – 10 + 7 =__________

2. 17 + 6 – 9 =__________

3. 16 + 14 – 10 =__________

4. 1 + 12 – 3 =__________

5. 20 + 12 – 16 =__________

6. 12 + 8 – 7 =__________

7. 11 + 16 – 9 =__________

8. 2 + 15 – 6 =__________

9. 13 + 7 – 4 =__________

10. 15 + 5 – 5 =_________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A5

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1. $20 - 20 + 13 =$__________

2. $11 + 1 - 1 =$__________

3. $14 + 14 - 10 =$__________

4. $7 + 12 - 2 =$__________

5. $20 + 11 - 16 =$__________

6. $13 + 7 - 7 =$__________

7. $12 + 18 - 9 =$__________

8. $8 + 15 - 8 =$__________

9. $14 + 8 - 5 =$__________

10. $13 + 6 - 5 =$_________

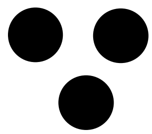
Appendix I

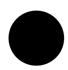
Noel's Answer Keys

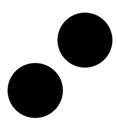
Curriculum-Based Assessment Mathematics

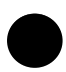
Single-Skill Computation Probe: Student Copy

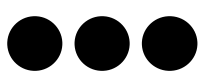
Date: ________________ KEY: A-4

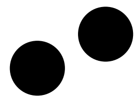
1.  = 1 2 3

2.  = 3 1 2

3.  = 2 3 1

4.  = 2 3 1

5.  = 3 2 1

6.  = 3 2 1

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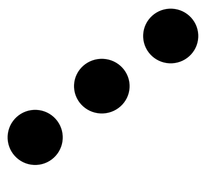
7.  = 1 2 3

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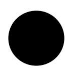
8.  = 3 2 1

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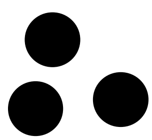
9.  = 2 1 3

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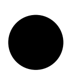
10.  = 1 2 3

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: __________________ KEY: A-2

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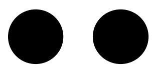
1.  = 1 2 3

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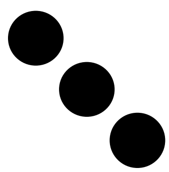
2.  = 3 1 2

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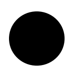
3.  = 2 3 1

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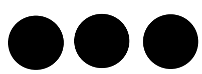
4.  = 2 3 1

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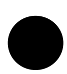
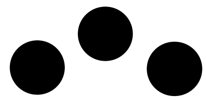
5.  = 3 2 1

6.  = 3 2 1

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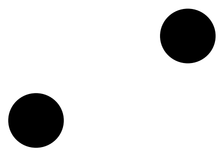
7.  = 1 2 3

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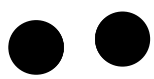
8.  = 3 2 1

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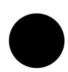
9.  = 2 1 3

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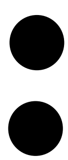
10.  = 1 2 3

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ____________________ WKST: A-3

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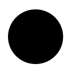
1.  = 1 | 2 | 3

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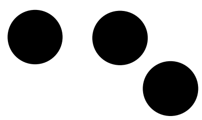
2.  = 3 | 1 | 2

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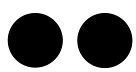
3.  = 1 | 3 | 2

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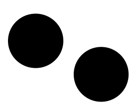
4.  = 3 | 2 | 1

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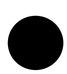
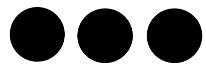
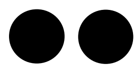
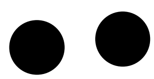
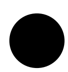
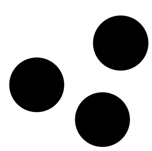
5.  = 3 | 2 | 1

6.  = 1 2 3

7.  = 2 3 1

8.  = 1 2 3

9.  = 2 1 3

10.  = 1 3 2

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ___________________ KEY: A-5

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1. ●

= 2 1 3

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2. ● ● ●

= 3 1 2

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3. ● ●

= 2 3 1

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4. ●

= 2 3 1

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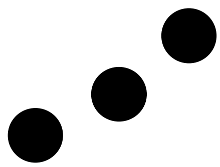
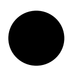
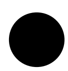
5. ● ● ●

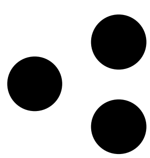
= 3 2 1

6.  = 3 2 1

7.  = 1 2 3

8.  = 3 2 1

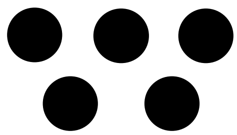
9.  = 2 1 3

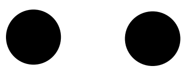
10.  = 1 2 3

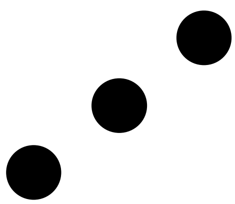
Curriculum-Based Assessment Mathematics

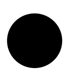
Single-Skill Computation Probe: Student Copy

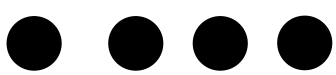
Date: ______________________ KEY: A1

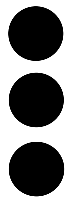
1.  = 4 3 5

2.  = 2 1 3

3.  = 1 3 2

4.  = 1 3 5

5.  = 5 4 2

6.  = 2 3 5

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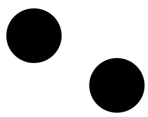
7.  = 1 5 2

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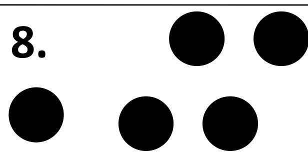
8.  = 4 3 5

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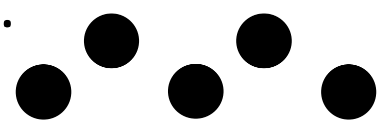
9.  = 5 4 2

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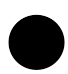
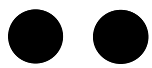
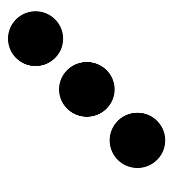
10.  = 3 1 2

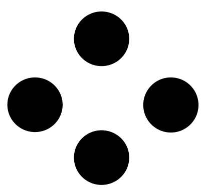
Curriculum-Based Assessment Mathematics

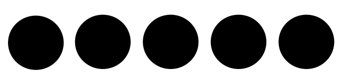
Single-Skill Computation Probe: Student Copy

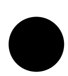
Date: ______________________ KEY: A2

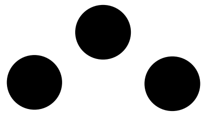
1.  = 1 2 3

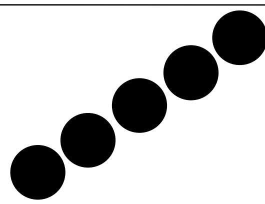
2.  = 3 5 2

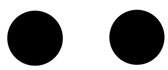
3.  = 2 4 1

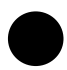
4.  = 5 3 4

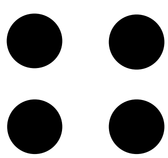
5.  = 4 2 1

6.  = 3 2 5

7.  = 5 4 3

8.  = 3 2 1

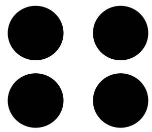
9.  = 2 1 4

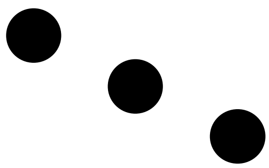
10.  = 4 2 3

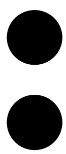
Curriculum-Based Assessment Mathematics

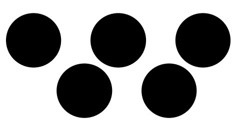
Single-Skill Computation Probe: Student Copy

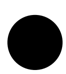
Date: ______________________ KEY: A3

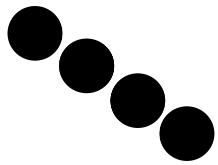
1.  = | 5 | 3 | 4 |

2.  = | 3 | 1 | 4 |

3.  = | 3 | 2 | 1 |

4.  = | 4 | 5 | 2 |

5.  = | 5 | 3 | 1 |

6.  = $\boxed{3}$ $\boxed{5}$ $\boxed{4}$

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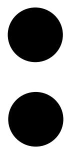
7.  = $\boxed{2}$ $\boxed{3}$ $\boxed{5}$

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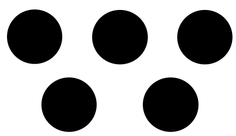
8.  = $\boxed{2}$ $\boxed{5}$ $\boxed{4}$

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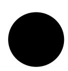
9.  = $\boxed{2}$ $\boxed{3}$ $\boxed{1}$

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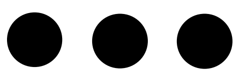
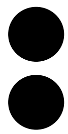
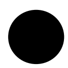
10.  = $\boxed{3}$ $\boxed{4}$ $\boxed{5}$

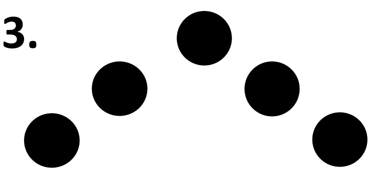
Curriculum-Based Assessment Mathematics

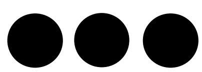
Single-Skill Computation Probe: Student Copy

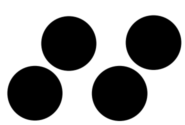
Date: ______________________ KEY: A4

1.  = 2 1 4

2.  = 5 3 1

3.  = 3 4 5

4.  = 3 1 2

5.  = 2 4 5

6. ● ● ● = $\boxed{3}$ $\boxed{1}$ $\boxed{2}$

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7. ● ● = $\boxed{1}$ $\boxed{2}$ $\boxed{4}$

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8. ● ● ● ● = $\boxed{5}$ $\boxed{3}$ $\boxed{4}$

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9. ● = $\boxed{3}$ $\boxed{1}$ $\boxed{5}$

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10. ● ● ● ● ● = $\boxed{5}$ $\boxed{3}$ $\boxed{4}$

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A5

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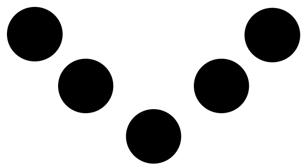
1.  = 4 5 3

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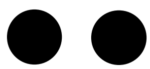
2.  = 1 4 2

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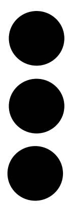
3.  = 3 1 5

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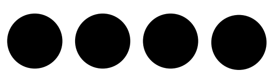
4.  = 1 4 3

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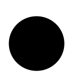
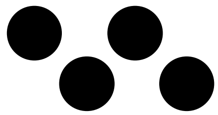
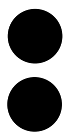
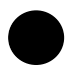
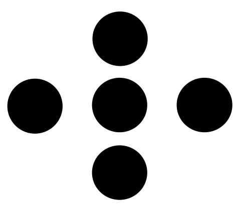
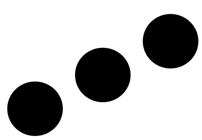
5.  = 5 1 4

6.  = 4 3 2

7.  = 4 2 5

8.  = 1 3 4

9.  = 3 5 2

10.  = 1 2 3

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A1

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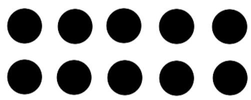
1.  = _______**10**_____

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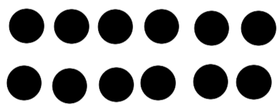
2.  = _______**12**_______

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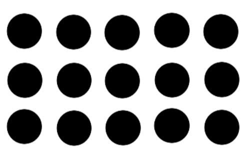
3.  = _______**15**_______

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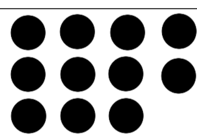
4.  = _______**11**_______

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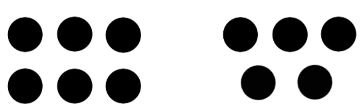
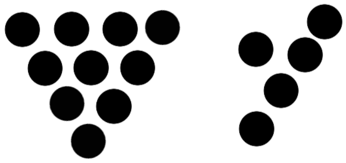
5.  = _______**11**_______

6.  =

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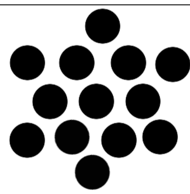
7.  =

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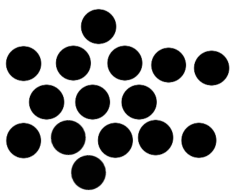
8.  =

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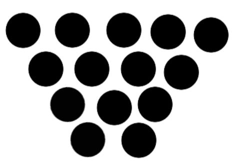
9.  =

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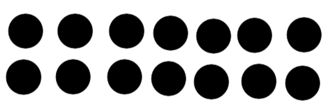
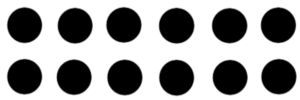
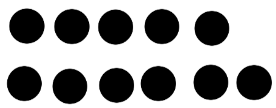
10.  = _______14_______

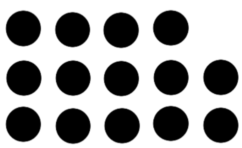
Curriculum-Based Assessment Mathematics

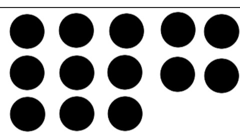
Single-Skill Computation Probe: Student Copy

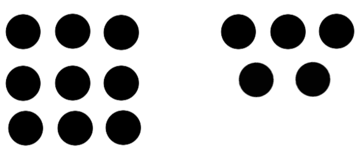
Date: ______________________ KEY: A2

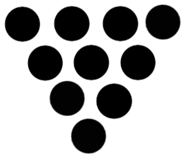
1.  = **______12______**

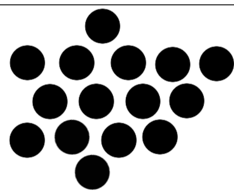
2.  = **______11________**

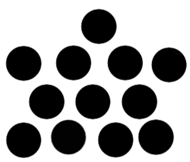
3.  = **_______14_______**

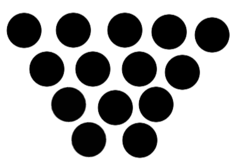
4.  = **_______13_______**

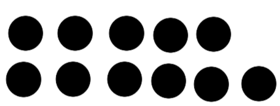
5.  = **______14________**

6.  = ______10______

7.  = _______15_____

8.  = ______12_______

9.  = ______14_______

10.  = _______11_______

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A3

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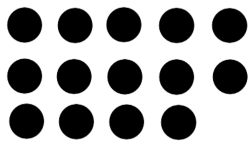
1.  **=** **_____14_____**

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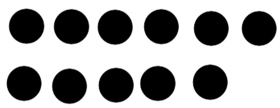
2.  **=** **_____11______**

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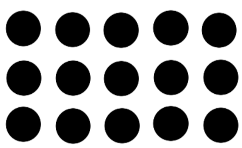
3.  **=** **______15______**

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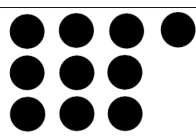
4.  **=** **______10______**

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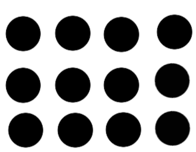
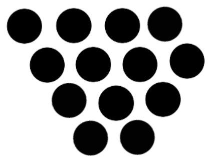
5.  **=** **______12______**

6.  =

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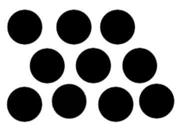
7.  =

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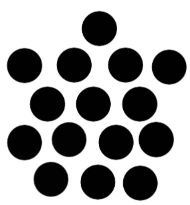
8.  =

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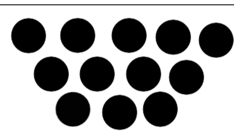
9.  =

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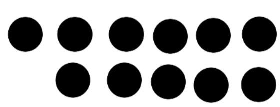
10.  = ________11________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A4

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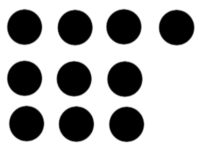
1.  **=** **_____10_______**

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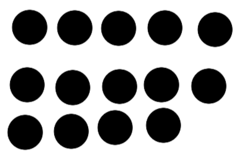
2.  **=** **_______14______**

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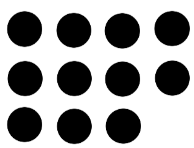
3.  **=** **______11_______**

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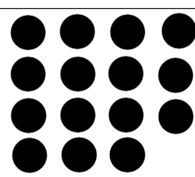
4.  **=** **_______15_______**

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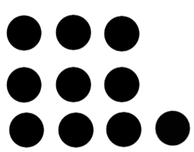
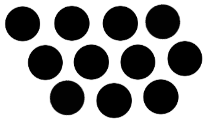
5.  **=** **_______10_______**

6.  =

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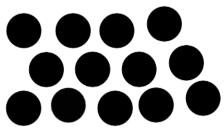
7.  =

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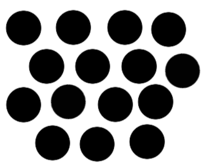
8.  =

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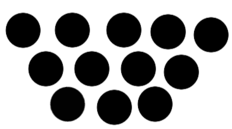
9.  =

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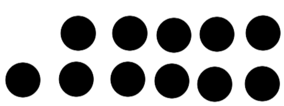
10.  = ________11_______

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A5

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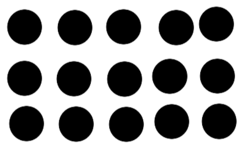
1.  = ______15______

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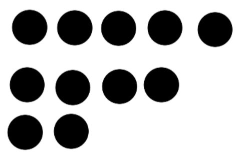
2.  = ________11____

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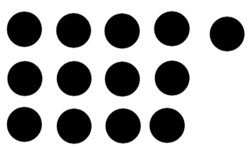
3.  = _______13______

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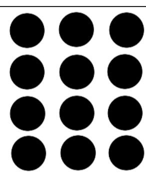
4.  = ________12______

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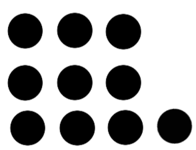
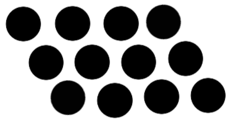
5.  = _______10_______

6.  =

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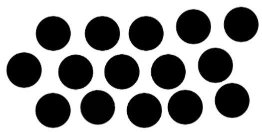
7.  =

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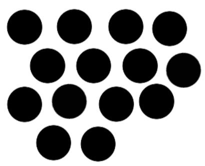
8.  =

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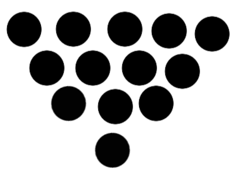
9.  =

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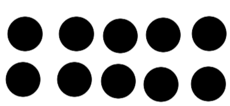
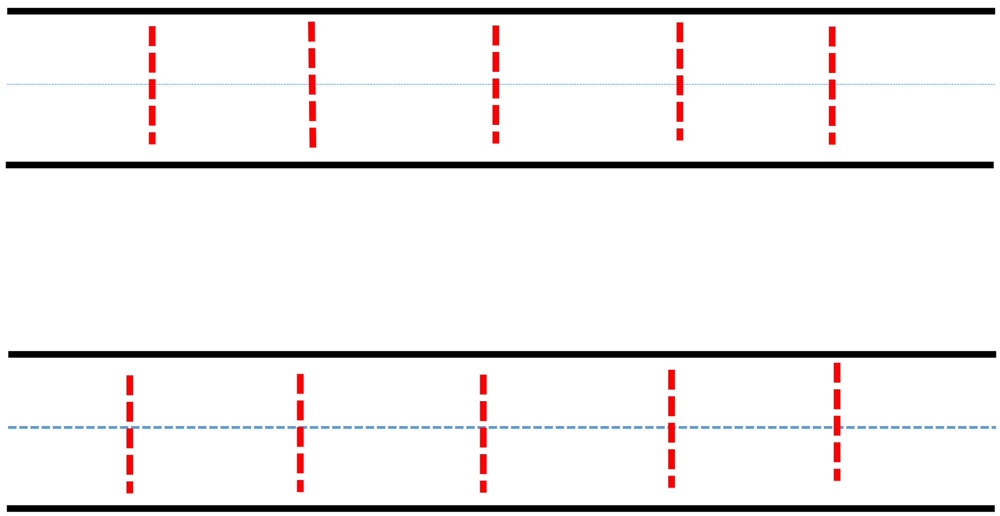
10.  = ________10________

Yanni Answer Key

Curriculum-Based Assessment Mathematics

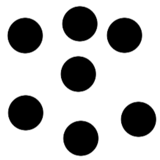
Date: ______________________ WKST: A1

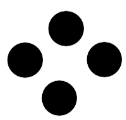


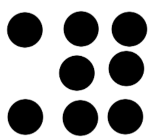
Curriculum-Based Assessment Mathematics

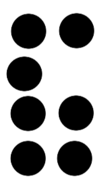
Single-Skill Computation Probe: Student Copy

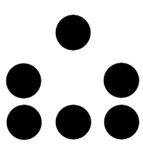
Date: ____________________ WKST: A-1

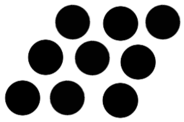
1.  = 7

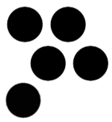
2.  = 4

3.  = 8

4.  = 7

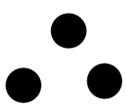
5.  = 6

6.  **=** 9 ________________

7.  **=** 5 ________________

8.  **=** 2 ________________

9.  **=** 4 ________________

10.  **=** 3 ________________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A-2

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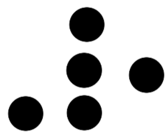
1.  = **5**

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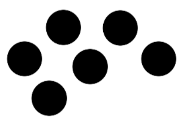
2.  = **6**

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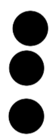
3.  = **3**

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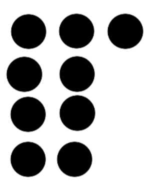
4.  = **9**

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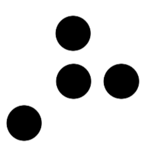
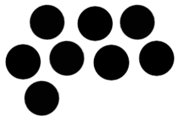
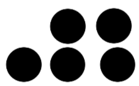
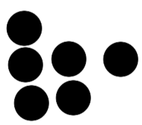
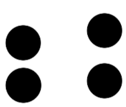
5.  = **4**

6.  = **8** ____________

7.  = **2** ____________

8.  = **5** ____________

9.  = **6** ____________

10.  = **4** ____________

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A-3

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1.  **=** **1**

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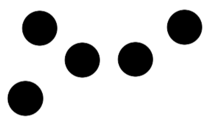
2.  **=** **5**

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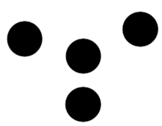
3.  **=** **4**

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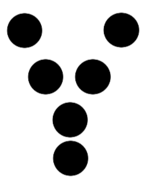
4.  **=** **6**

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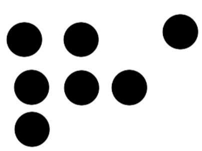
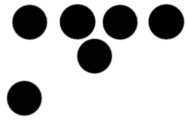
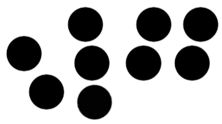
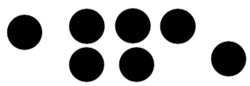
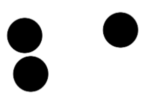
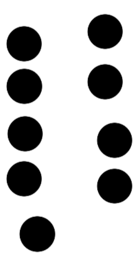
5.  **=** **7**

6.  = **6** ________________

7.  = **9** ________________

8.  = **7** ________________

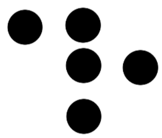
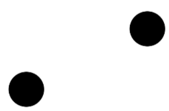
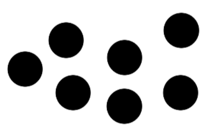
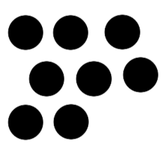
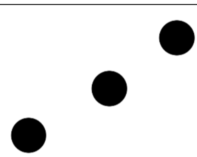
9.  = **3** ________________

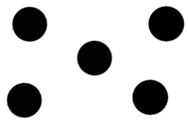
10.  = **9** ________________

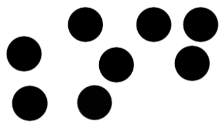
Curriculum-Based Assessment Mathematics

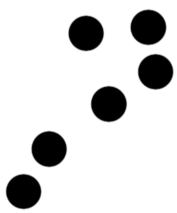
Single-Skill Computation Probe: Student Copy

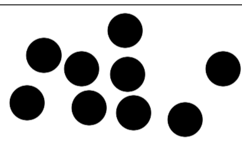
Date: ______________________ WKST: A-4

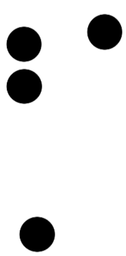
1.		**=**	**5**
2.		**=**	**2**
3.		**=**	**7**
4.		**=**	**8**
5.		**=**	**3**

6.  = 5

7.  = 8

8.  = 6

9.  = 9

10.  = 4

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A-5

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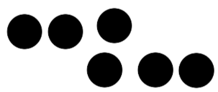
1.  = **6** ________________

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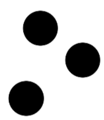
2.  = **3** ________________

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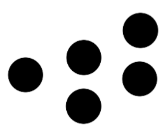
3.  = **5** ________________

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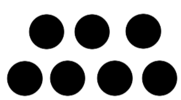
4.  = **7** ________________

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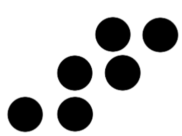
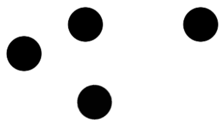
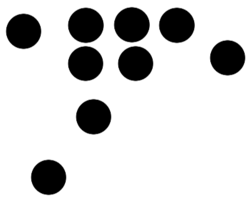
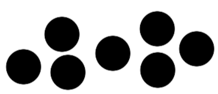
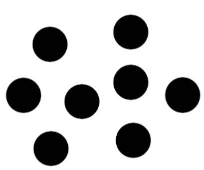
5.  = **6** ________________

6.  = **2** ____________

7.  = **4** ____________

8.  = **9** ____________

9.  = **7** ____________

10.  = **8** ____________

Nathan's Answer Keys

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ WKST: A1

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1. 19 – 2 + 3 =___20_______

2. 13 + 6 – 7 =_____12______

3. 16 + 9 – 5 =_____20______

4. 1 + 16 – 4 =______13_____

5. 20 + 17 – 18 =_____19______

6. 14 + 8 – 9 =_____13______

7. 11 + 16 – 7 =_____20______

8. 0 + 15 – 4 =_____11______

9. 12 + 5 – 2 =_____15______

10. 18 + 2 – 6 =_____14_____

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ Key: A2

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1. 14 + 6 – 8 =____12_____

2. 7 + 12 – 4 =____15_____

3. 11 + 2 – 3 =____10_____

4. 5 + 12 – 5 =____12_____

5. 16 + 4 – 0 =____20_____

6. 20 + 8 – 9 =____19_____

7. 14 + 9 – 3 =____20_____

8. 10 + 6 – 1 =____15_____

9. 19 + 0 – 6 =____13_____

10. 10 + 12 – 2 =___20_____

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A3

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1. 14 – 2 + 3 =____15_____

2. 3 + 16 – 9 =____10_____

3. 13 + 8 – 5 =____16_____

4. 3 + 16 – 8 =____11_____

5. 19 + 7 – 6 =____20_____

6. 20 + 8 – 9 =____19_____

7. 11 + 12 – 7 =___16______

8. 10 + 3 – 2 =____11_____

9. 19 + 0 – 9 =____10_____

10. 10 + 3 – 2 =____11____

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ KEY: A4

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1. 20 – 10 + 7 =____17_____

2. 17 + 6 – 9 =______14____

3. 16 + 14 – 10 =___20______

4. 1 + 12 – 3 =______10____

5. 20 + 12 – 16 =___16______

6. 12 + 8 – 7 =______13____

7. 11 + 16 – 9 =____18_____

8. 2 + 15 – 6 =______11____

9. 13 + 7 – 4 =______16____

10. 15 + 5 – 5 =______15___

Curriculum-Based Assessment Mathematics

Single-Skill Computation Probe: Student Copy

Date: ______________________ Key: A5

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1. 20 – 20 + 13 =____13_____
2. 11 + 1 – 1 =_______11___
3. 14 + 14 – 10 =____18_____
4. 7 + 12 – 2 =_______17___
5. 20 + 11 – 16 =____15_____
6. 13 + 7 – 7 =_______13___
7. 12 + 18 – 10 =____20____
8. 8 + 15 – 8 =_______15__
9. 14 + 8 – 5 =_______17___
10. 13 + 6 – 5 =_______14__

Appendix J

Social Acceptability Survey

Student Name: Date:		
1. I liked the peer feedback system	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?
2. I liked scoring my own work	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?
3. I liked my partner scoring your work	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?
4. I know my math IEP goal	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?
5. I want to continue to use the peer feedback system	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?

Teacher/Staff Name: Date:		
1. I liked the peer feedback system	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?
2. I liked the students scoring their own work	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?
3. I liked the partners scoring the paired student's work	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?
4. I did not feel like the procedure was extra work	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?
5. I want to continue to use the peer feedback system	1 Strongly agree 2 3 4 5 Strongly disagree	Additional comments?

Table 1.
Social Acceptability Survey Results

Participant	Question 1	Question 2	Question 3	Question 4	Question 5
Noel	1	1	1	5	5
Laura	1	1	1	1	1
Yanni	1	1	1	5	1
Brad	1	1	1	5	1
Robert	1	5	2	5	1
Nathan	1	1	5	1	1
Range	**(1)**	**(1-5)**	**(1-5)**	**(1-5)**	**(1-5)**
Average	**1**	**2.5**	**1.8**	**3.7**	**1.6**
Dyad One Teacher	1	1	1	1	2
Dyad Two and Three Teacher	4	3	No Opinion	5	No Opinion
Range	**(1-4)**	**(1-3)**	**NA**	**(1-5)**	**NA**
Average	**2.5**	**2**	**1**	**3**	**2**

Note. All scores are measured using a Likert scale. Scores in bold show the range of scores collected and the average of all scores compiled.

Appendix K

Participant Researcher Constructed Goals

Noel Teacher written IEP Annual Goal: Noel will be able to rote count, identify numbers, and count using touch points or pictures of numbers 10-20 with 80% accuracy. Study Annual Objective: Given 10 pictures each containing between 1-13 objects and a verbal prompt of "Count the images and circle the correct answer", Noel will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 1 Given 10 pictures each containing between 1-3 objects and a verbal prompt of "Count the images and circle the correct answer", Noel will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 2 Given 10 pictures each containing between 1-5 objects and a verbal prompt of "Count the images and circle the correct answer", Noel will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 3 Given 10 pictures each containing between 1-7 objects and a verbal prompt of "Count the images and circle the correct answer", Noel will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

SLICE 4 Given 10 pictures each containing between 1-10 objects and a verbal prompt of “Count the images and circle the correct answer”, Noel will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 5 Given 10 pictures each containing between 1-13 objects and a verbal prompt of “Count the images and circle the correct answer”, Noel will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

Brad Teacher written IEP Annual Goal: By February, 2017, Brad will be able to correctly add 10 and subtract 10 single digit problems using numbers 0-15 on a number line and or touch math with 1-2 prompts. Study Annual Objective: Given 10 pictures each containing between 20-30 objects and a verbal prompt of “Count the images and circle the correct answer”, Brad will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 1 Given 10 pictures each containing between 10-15 objects and a verbal prompt of “Count the images and circle the correct answer”, Brad will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 2 Given 10 pictures each containing between 15-20 objects and a verbal prompt of “Count the images and circle the correct answer”, Brad will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

SLICE 3 Given 10 pictures each containing between 10-20 objects and a verbal prompt of “Count the images and circle the correct answer”, Brad will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 4 Given 10 pictures each containing between 20-25 objects and a verbal prompt of “Count the images and circle the correct answer”, Brad will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 5 Given 10 pictures each containing between 20-30 objects and a verbal prompt of “Count the images and circle the correct answer”, Brad will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

Laura <u>Teacher written IEP Annual Goal:</u> By October 28, 2016 Laura will be able to add and subtract two numbers with a sum up to 18 using touch points, manipulative, or counting on or backwards to get a sum with 80% accuracy. <u>Study Annual Objective</u> Given 10 pictures each containing between 25-30 objects and a verbal prompt of “Count the images and write the correct answer”, Laura will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 1 Given 10 pictures each containing between 15-20 objects and a verbal prompt of “Count the images and write the correct answer”, Laura will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

SLICE 2 Given 10 pictures each containing between 15-20 objects and a verbal prompt of "Count the images and write the correct answer", Laura will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 3 Given 10 pictures each containing between 10-20 objects and a verbal prompt of "Count the images and write the correct answer", Laura will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 4 Given 10 pictures each containing between 20-25 objects and a verbal prompt of "Count the images and write the correct answer", Laura will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 5 Given 10 pictures each containing between 25-30 objects and a verbal prompt of "Count the images and write the correct answer", Laura will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

Yanni Teacher written IEP Annual Goal: Yanni will by January 5, 2017 be able to add two groups of objects or pictures with sums up to 10 with 80% accuracy. Study Annual Objective: Given 8 dashed number 1's and 2 blank spaces a verbal prompt of "Trace the number 1 and then write the number 1 ", Yanni will trace within 4mm of the numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

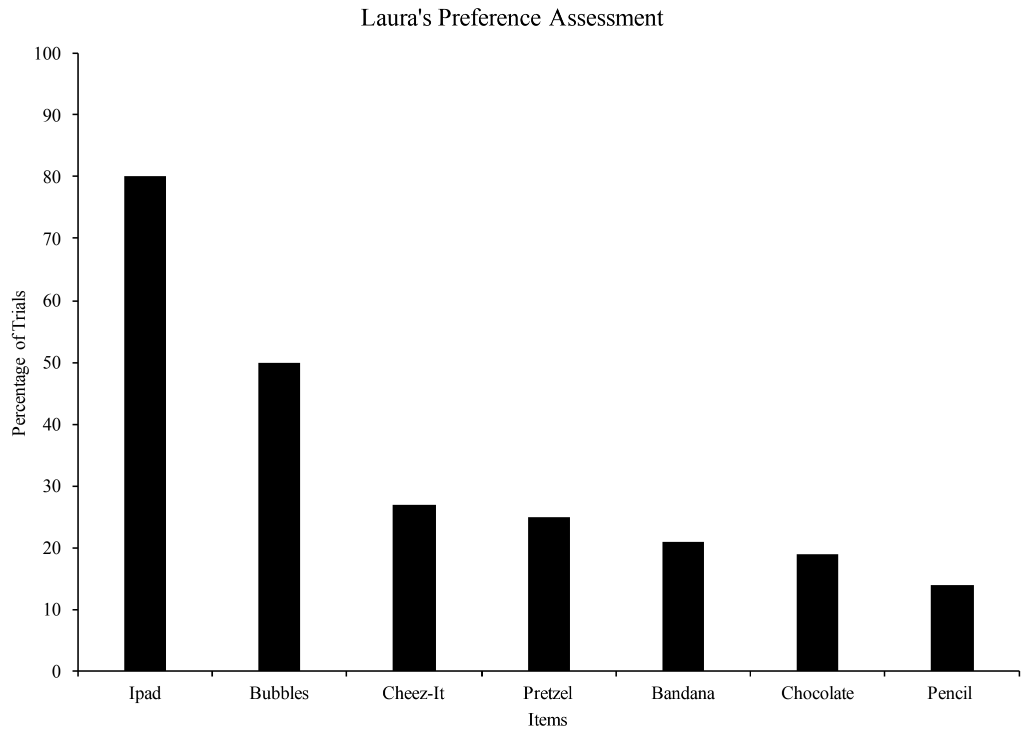
SLICE 1 Given 10 dashed number 1's and a verbal prompt of "Trace the number 1", Yanni will trace within 4mm of the numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 2 Given 10 dashed number 1's and a verbal prompt of "Trace the number 1", Yanni will trace within 2mm of the numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 3 Given 10 dashed number 1's and a verbal prompt of "Trace the number 1", Yanni will trace within 1mm of the numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 4 Given 10 dashed number 1's and a verbal prompt of "Trace the number 1", Yanni will trace within 0cm of the numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 5 Given 8 dashed number 1's and 2 blank spaces a verbal prompt of "Trace the number 1 and then write the number 1 ", Yanni will trace within 4cm of the numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

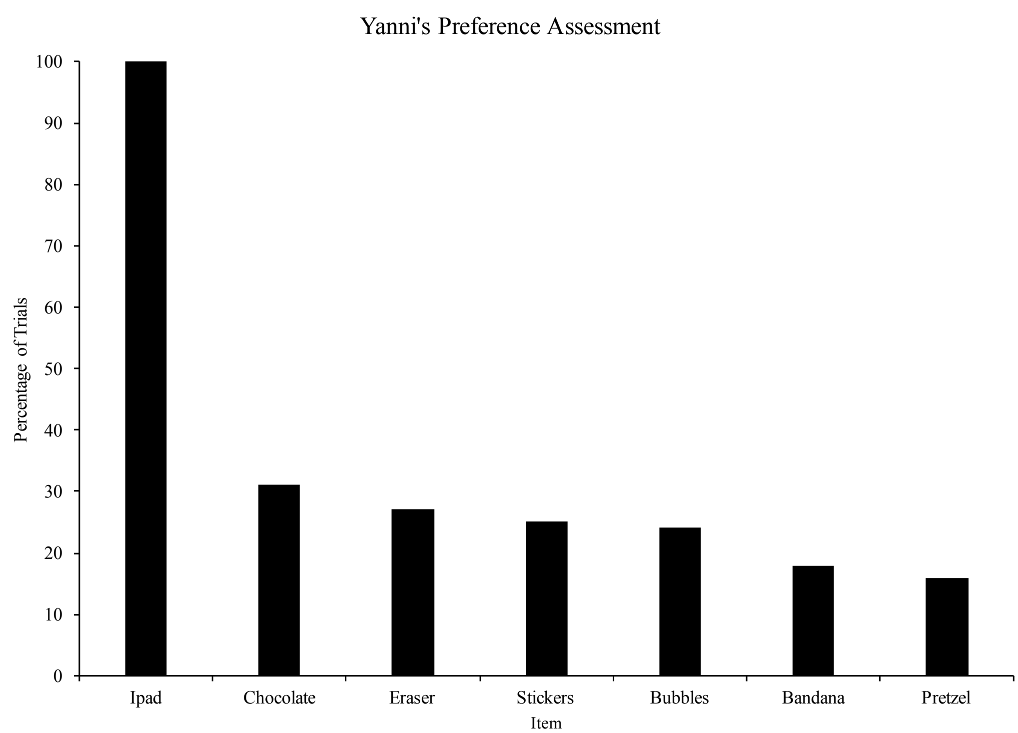
Robert <u>Teacher Written Objective</u> By February, 2017, Robert will be able to add and subtract 10 math problems between numbers 0-20 with 1-2 prompts. <u>Study Annual Objective:</u> Given 10 pictures each containing between 20-30 objects and a verbal prompt of “Count the images and circle the correct answer”, Robert will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 1 Given 10 pictures each containing between 10-15 objects and a verbal prompt of “Count the images and circle the correct answer”, Robert will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 2 Given 10 pictures each containing between 15-20 objects and a verbal prompt of “Count the images and circle the correct answer”, Robert will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 3 Given 10 pictures each containing between 20-25 objects and a verbal prompt of “Count the images and circle the correct answer”, Robert will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 4 Given 10 pictures each containing between 25-30 objects and a verbal prompt of “Count the images and circle the correct answer”, Robert will select the correct number from an array of three numbers with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

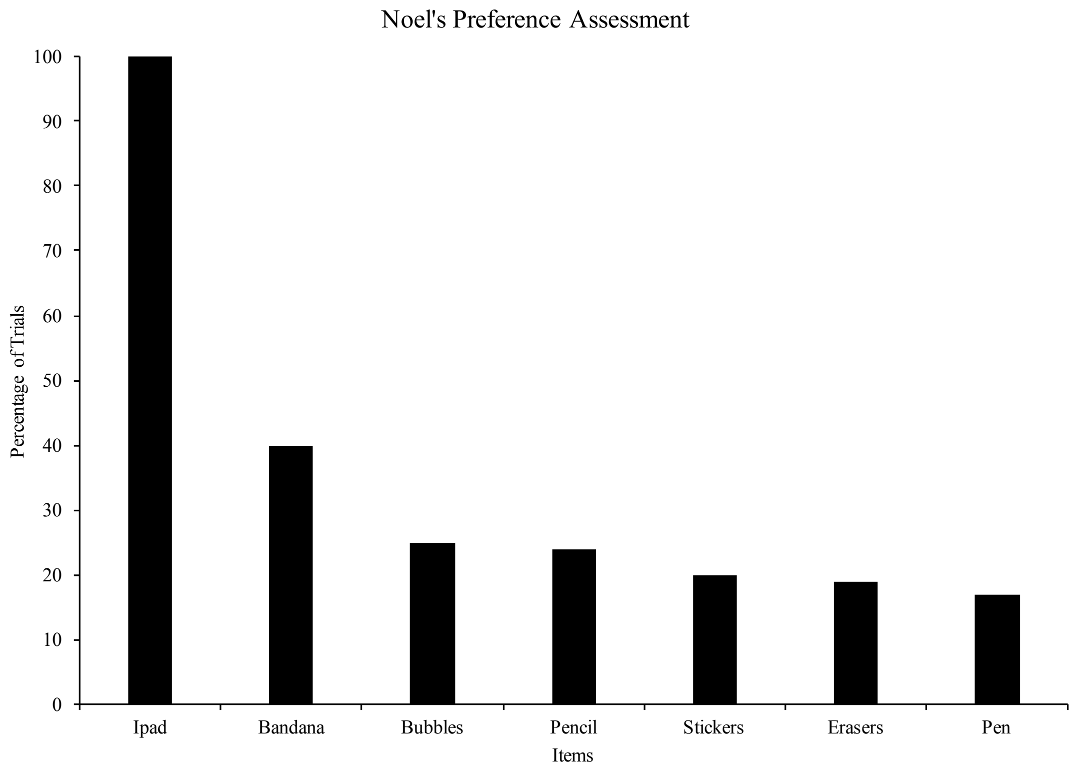
Nathan Teacher Written Objective: By March, 2017, Nathan will independently count an assortment of coins and bills up to $5.00 in 3/5 trails. Study Annual Objective: Given 10 addition and subtraction problems each containing numbers that equal a sum between 30-35 and a verbal prompt of “Solve the problem”, Nathan will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 1 Given 10 addition and subtraction problems each containing numbers that equal a sum between 10-20 and a verbal prompt of “Solve the problem”, Nathan will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 2 Given 10 addition and subtraction problems each containing numbers that equal a sum between 15-20 and a verbal prompt of “Solve the problem”, Nathan will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 3 Given 10 addition and subtraction problems each containing numbers that equal a sum between 20-25 and a verbal prompt of “Solve the problem”, Nathan will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.
SLICE 4 Given 10 addition and subtraction problems each containing numbers that equal a sum between 25-30 and a verbal prompt of “Solve the problem”, Nathan will write the correct number with 80% accuracy across 2 consecutive trials as measured by student self-recording and research assistant recording.

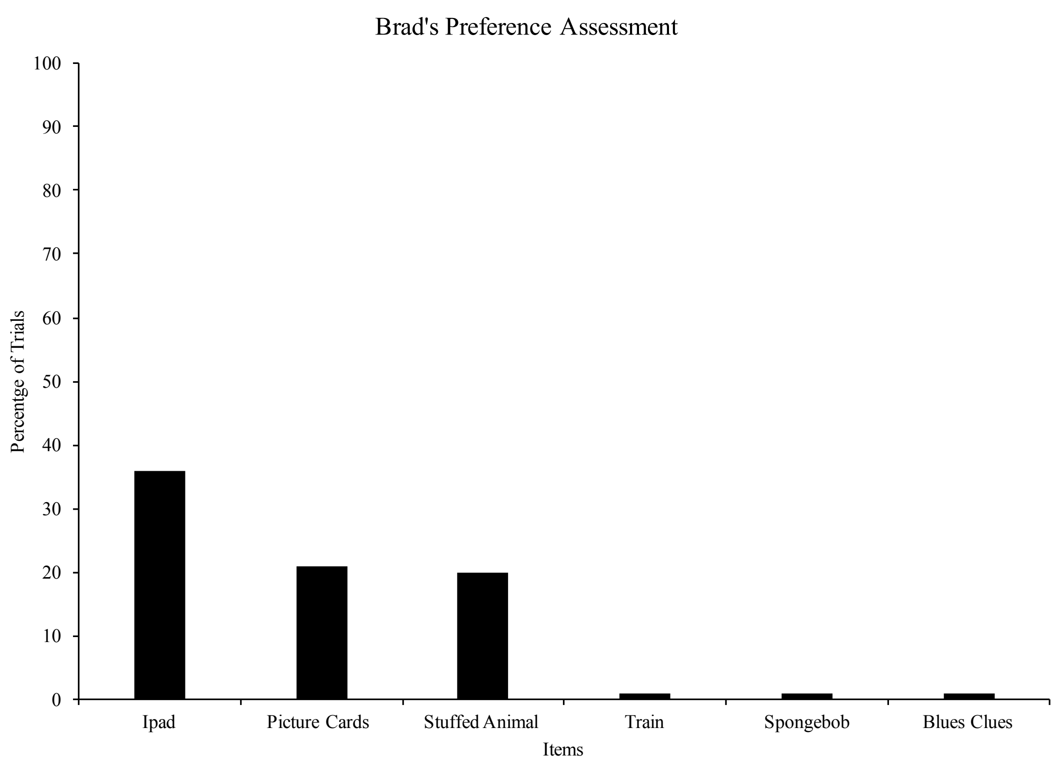
Appendix L

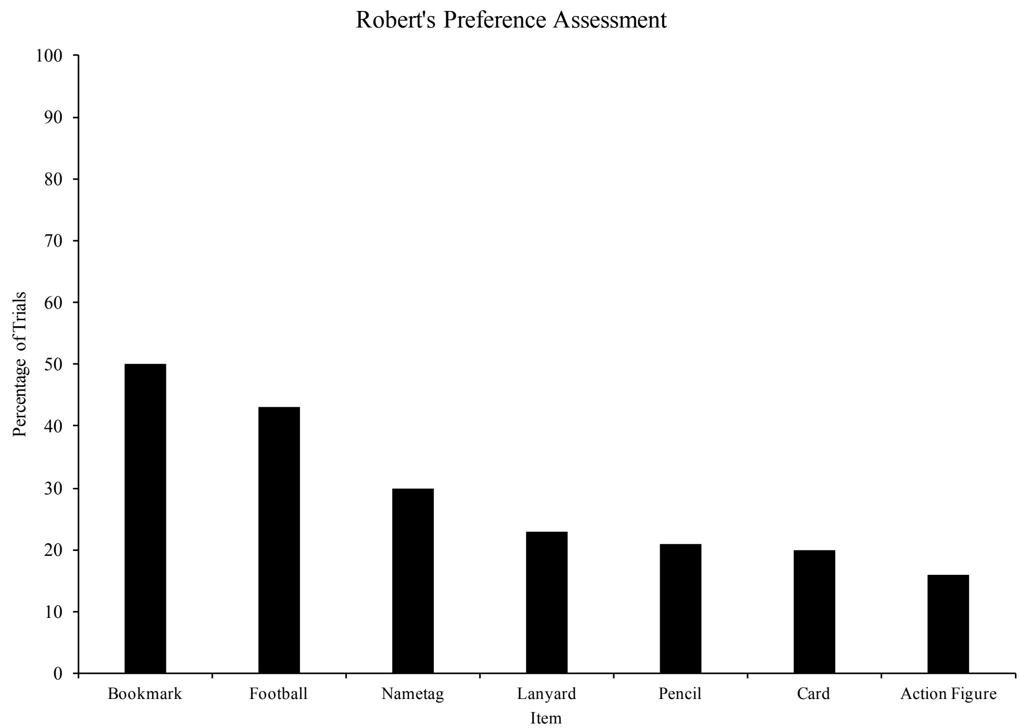
Participant Preference Assessments

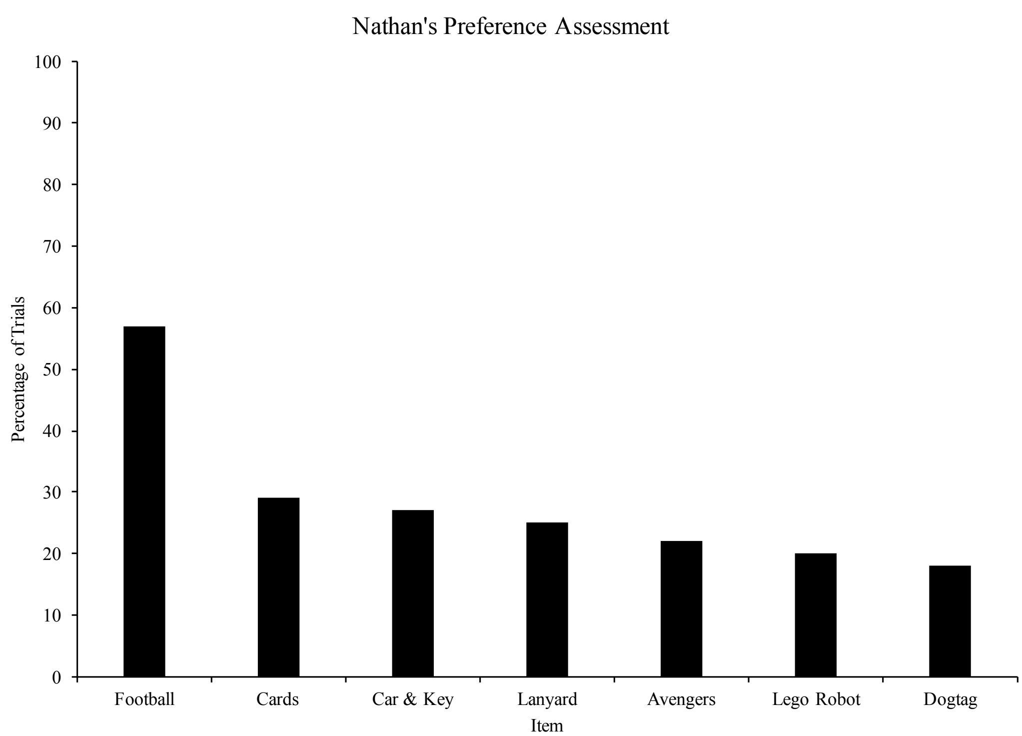





Noel's Preference Assessment
Percentage of Trials
100
90
80
70
60
50
40
30
20
10
0
Ipad
Bandana
Bubbles
Pencil
Stickers
Erasers
Pen
Items


Brad's Preference Assessment
Percentge of Trials
100
90
80
70
60
50
40
30
20
10
0
Ipad
Picture Cards
Stuffed Animal
Train
Spongebob
Blues Clues
Items


Robert's Preference Assessment
Percentage of Trials
0
10
20
30
40
50
60
70
80
90
100
Bookmark
Football
Nametag
Lanyard
Pencil
Card
Action Figure
Item


Nathan's Preference Assessment
Percentage of Trials
0
10
20
30
40
50
60
70
80
90
100
Football
Cards
Car & Key
Lanyard
Avengers
Lego Robot
Dogtag
Item

Appendix M

Standard Teacher Script

Negative Remark:
If the student stated a negative remark about their progress towards their math goal (e.g. "I never make my slice!") the teacher would state "Remember to keep trying and maybe tomorrow you will beat your score!"

Positive Remark:
If the student stated a positive remark about their progress towards their math goal (e.g. "I beat my slice today!") the teacher would state "That's great! Keep trying and maybe tomorrow you will beat the next slice!"

Appendix N

Interobserver Agreement Scoring Table

Table 2

Interobserver Agreement Date and Score Table for Math Performance

Laura		Yanni		Noel		Brad		Robert		Nathan	
Date	Score	Date	Score	Date	Score	Date	Score	Date	Score	Date	Score
4/18/16	100	4/18/16	90	5/5/16	100	5/3/2016	100	5/11/16	100	5/16/16	100
4/21/16	100	4/21/16	100	5/13/16	100	5/11/16	100	5/16/16	100	5/19/16	100
4/26/16	100	4/26/16	100	5/18/16	100	5/17/16	100	5/20/16	100	5/24/16	100
4/29/16	100	4/29/16	100	5/23/16	100	5/20/16	100	5/25/16	90	5/27/16	100
5/5/16	90	5/6/16	100	5/24/16	100	5/25/16	100	5/27/16	100	5/31/16	90
5/10/16	100	5/11/16	80	5/31/16	100	5/26/16	90	6/7/16	100	6/7/16	90
5/18/16	100	5/17/16	100	6/3/16	100	5/31/16	100	6/10/16	100	6/10/16	100
5/24/16	100	5/23/16	100	6/7/16	100	6/1/16	90				
5/31/16	100	5/31/16	100	6/9/16	100	6/8/16	100				
6/8/16	100	6/10/16	90	6/10/16	100						

Note. The table above displays the dates IOA was collected and calculated. Scores for IOA were calculated by using trial by trial agreement.

Appendix O

HSIRB Approval Form

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: April 14, 2016

To: Jessica Frieder, Principal Investigator
Allaina Sheltrown, Student Investigator for thesis
Student investigator: Brenton Groehn, Angelica Sedano

From: Amy Naugle, Ph.D., Chair Amy Naugle

Re: HSIRB Project Number 16-02-10

This letter will serve as confirmation that the change to your research project titled "The Effects of a Peer Feedback Treatment Package on Math Performance in Students with Moderate Cognitive Impairments" requested in your memo received April 13, 2016 (to add student investigator Brenton Groehn and Angelica Sedano) has been approved by the Human Subjects Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: **February 16, 2017**

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