A Comparative Analysis of the CABAS® Model of Education at the Fred S. Keller School: A Twenty-Year Review

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Abstract

The Comprehensive Application of Behavior Analysis to Schooling or CABAS® model is characterized by an organizational system of teacher training and mentoring by those with more expertise in the science of behavior analytic teaching. At the center of the system are the students, whose data drive the system. Decades of research support the CABAS® model as a whole as well as its components, which include a fundamental unit of measure and analysis, a criterion-referenced assessment that is also a curriculum, and the incorporation of teacher training modules created to develop teachers who are strategic scientists of pedagogy. When the CABAS® system was first analyzed in 1989, data across one school year reflected the increased effectiveness of instruction as measured by student outcomes. Twenty years later, we provide a comparative analysis of data from a similar school where the CABAS® model has been faithfully implemented for over two decades. Our data reflect an evolution of the CABAS® model, as a function of increased teacher expertise, more accurate and valid measurement and analyses of relevant data, and more effective assessment and teaching strategies, all of which have lead to improved student outcomes.

Keywords: Comprehensive Application of Behavior Analysis to Schooling; CABAS®; learn units; C-PIRK assessment; preschool children

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The Comprehensive Application of Behavior Analysis to Schooling, or CABAS®, model of education has been in existence for almost three decades. CABAS® is a data-driven, research-based system that takes into account the interdependent relationship between teachers, students and their parents, and school supervisory personnel, whose primary function is to train and mentor teachers to continually apply the principles and tactics of the science of behavior to ensure student success. A university graduate training program ensures that the training incorporates the latest scientific findings and consultation to board certified schools by CABAS® Professional Advisory Board members, who are themselves senior behavior analysts and research scientists, ensures the accurate implementation of all components of the CABAS® model. Students are at the center of the system and it is continuous measurement of their behaviors that provides evidence of the effectiveness of the system. CABAS® also includes a behavioral parent education program (please refer to Greer, 2002 or Greer, Keohane, & Healy, 2002) for a full description of these CABAS® components). All those involved are responsive to student data, at the level of the individual child, classroom, or school as a whole.

CABAS® is a cybernetic system, at the heart of which lie the students. Our students' achievement is directly tied to their teachers' expertise (Greer, 2002; Greer, et al, 2002). Students learn only as fast as their teachers can teach them. The amount of instruction received (measured in learn units, described later in this paper) and the number of objectives achieved by students is a direct measure of teacher behavior. And, those objectives are tied directly to state standards, so our teachers are accountable at all levels for the achievement of their students. Our model is designed such that, just as teachers are responsible for their students' achievement, teacher mentors and behavior analyst supervisors are responsible for the performance of their teachers. And beyond that, CABAS® consultants and university faculty are responsible for the performance of teacher mentors and behavior analysts.

CABAS® meets the criteria set forth by the No Child Left Behind act (NCLB), including: 1) accountability for results, as evidenced by a set of measures reflecting both teacher and student performance across the entire school year, 2) scientifically-based instruction, as evidenced by the use of tactics from the research literature of the science of behavior, 3) highly qualified teachers and teaching assistants, accomplished through a three-tiered personalized system of instruction that includes a teacher training and observation component as well as other outcome-based measures of teacher expertise, and 4) assessment of individualized student progress**,** including the use of criterion-referenced assessments and curricula tied to state standards.

The CABAS® model also contains components which meet the definition of a Response to Instruction Model (RTI) (Vaughn & Fuchs, 2003) in that 1) all students are assessed for repertoires and capabilities, 2) responses to instruction are monitored, 3) data are analyzed and a course of action is determined, 4) all decisions regarding interventions are individualized to the specific student and 5) the integrity of the implementation of tactics is closely monitored. Interventions in an RTI model are multi-tiered, with students who are not responding to intervention moving to a more rigorous or simply different tier of intervention. Our decision analysis protocol, described later in this paper, was designed to analyze learning problems within the context of the instructional setting and, in response, implement appropriate tactics based on where the learning problem existed (e.g., lack of prerequisite skills; motivation, instructional history, conditioned reinforcement).

In summary, the CABAS® model of education employs a science of pedagogy to all aspects of teaching and learning. Our students succeed because their teachers succeed. Our teacher training system ensures this. The following is a descriptive and comparative summary of the variables associated with the CABAS® model of schooling and their effects on student outcomes after 20 years of implementation in one preschool. This paper reflects the evolution of CABAS® at the Fred S. Keller School.

The Evolution of an Effective Behavior Analytic Preschool Program

The Fred S. Keller School was established in 1986 with an enrollment of 3 preschool children as a program geared towards educating young children from low socio-economic backgrounds with behavior disorders. At the start of the 1988-1989 school year, the population of students had shifted as the need in the community changed. The number of students being referred with a diagnosis of autism and pervasive developmental disorder had dramatically increased and, as a result, the enrollment grew to 66 half-day students by year's end. During this school year, many components of the CABAS® model as it exists today were already in place. Some of these included 1) direct and frequent measures of student performance, including school-wide data analysis and public posting of data 2) direct and frequent measures of teacher performance, known as "teacher observations," 3) a behavioral assessment and curriculum entitled the Preschool Inventory of Repertoires for Kindergarten (PIRK) which records students' performance under varying conditions, 4) a Personalized System of Instruction for teacher training modules, and 5) application of research-based tactics from the literature of the science of behavior.

Over the past 20 years, advances in the science of behavior and the results of research conducted across all of the CABAS® programs worldwide have led to improved teaching procedures and measures of that instruction, more effective teacher training tools, a more comprehensive assessment of student repertoires and subsequent objectives, and, so it follows, better outcomes for students.

New or Improved CABAS® Components

The effectiveness of the Comprehensive Application of Behavior Analysis to Schooling (CABAS®) model is not new and has been reported in the seminal research on the model, including a sustained analysis of the model (Selinski, Greer, & Lodhi, 1989), a functional analysis of the model (Greer, McCorkle, & Williams, 1991), and a systematic replication of the CABAS® model at a school in Italy (Lamm & Greer, 1991). While it has been almost 20 years since an experimental analysis of the effectiveness of CABAS® schools as a whole has been published, numerous studies have confirmed the success of many of the components of the model. What follows is an overview of those systematic changes or additions to the system over the past 20 years that we believe have had the most impact on the effectiveness of our program and the outcomes of our students.

The learn unit

One of our model's basic tenets is at once a method for delivering instruction, a unit of measure, and a basis for analysis of student learning. The learn unit (Albers & Greer, 1992; Greer & McDonough, 1999) involves an interaction between a teacher (or teaching device such as a computer) and a student. The teacher presents unambiguous, clear, and complete instructions or antecedents, the student responds accordingly, and the teacher then delivers a consequence, which comes in the form of either reinforcement (praise, points, check marks) or an error correction procedure. Studies have shown that students learn four to seven times more when learn units are in place than when they are absent or incomplete (Albers & Greer, 1991; Ingham & Greer, 1992; Selinske et al., 1991). In some regular education settings, students wait 30 minutes for a learn unit (Greer, 1994). In CABAS® settings, learn units occur on average four times per minute. Each teacher-presented learn unit consists of at least two three-term contingencies for the teacher and one for the student that interlock, such that the teacher responds to the student's behavior and, in turn, the student responds according to the teacher's behaviors. Note the following example: A student is looking at the teacher (teacher antecedent), the teacher asks the question, "What is the sum of 2 and 4?" (teacher behavior + student antecedent), the student responds, "6" (student response + teacher consequence/ teacher antecedent), the teacher says, "That is the right sum" (student consequence + teacher behavior), end of the learn unit (teacher consequence). Systematic observation of learn unit presentations by trained observers can result in analysis and subsequent identification of the source of instructional difficulties.

Teacher Performance Rate Accuracy (TPRA) scale

In CABAS® programs we measure the accuracy of and rate with which teachers present learn units to students. The teacher observation system that existed in 1988 has become a training and evaluation tool known as the Teacher Performance Rate and Accuracy Scale (TPRA). The TPRA observation, conducted by behavior analyst supervisors or Master Teachers who are training junior teachers and teaching assistants, ensures that intact, flawless learn units are presented at appropriate rates to support active student responding (Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2005). Increasing the number of errorless TPRAs has been shown to increase the accuracy with which students respond (Ingham & Greer, 1992). During a TPRA observation, the observer collects data on the student's responses, records the antecedents and consequences presented by the teacher (as correct or incorrect) and records the time it takes for the teacher to complete the target program. Errors or other problems contributing to instructional difficulties may occur in the teacher's instructional stimuli or delivery of the antecedent, the response from the student, or the consequence from the teacher (e.g., reinforcement or correction errors or omissions) and can be identified, and thus corrected, at any time during an instructional session. The TPRA observation procedure is at once an evaluative measure as well as a diagnostic tool.

Decision-tree protocol for data analysis

The learn unit is not only the fundamental method of presenting instruction and consequating student responses. It is also a unit of analysis. As students respond, teachers continually measure and record their responses. These data are then immediately graphed for further analysis using a decision-tree protocol (Keohane & Greer, 2005), which did not exist in the 1988-1989 school year. When a student's data do not demonstrate learning (a steep, ascending trend in correct responses) a well-trained teacher or observer can immediately spot the problem and analyze what is impacting the student's progress. The problem may lie in the teacher's antecedent or instructional materials, the student's instructional history or the topography of the response, or the problem may lie with motivational or reinforcement events. The data decision analysis protocol includes algorithms for when to intervene and make decisions relative to a student's performance. First- and second-level decisions include noting when a child has met criterion for a certain objective, identification of an ascending trend indicating student learning, or when the data demonstrate a descending or no trend. Higher-level decisions include analysis of where the problem may lie within the context of the learn unit, subsequent implementation of relevant tactics from the literature of the science to remediate learning difficulties, and further analysis to determine whether the tactic was successful or whether a different tactic is warranted.

C-PIRK assessment

The *Preschool Inventory of Repertoires for Kindergarten* (PIRK) was originally developed in 1986 to assess 190 behaviors across 6 major categories and 11 sub-categories (See Table 1). This was the version of the PIRK used during the 1988-1989 school year. Several versions of the PIRK have been implemented over the years, as the number and scope of repertoires to be assessed has evolved. Today, the *CABAS® International Curriculum and Inventory of Repertories for Preschool through Kindergarten* (2009) or C-PIRK is the assessment tool administered to Early Intervention and Preschool students in CABAS® programs upon enrollment and at regular intervals for the duration of their time in the program. In fact, a recent study found that children who were assessed and instructed according to the repertoires found in the C-PIRK improved in the areas of communication, social skills, adaptive behaviors, and daily living skills and were better prepared to succeed in mainstream educational settings, compared to their counterparts who received different types of instruction (Waddington & Reed, 2009).

The C-PIRK also serves as the individualized curriculum for each student. The C-PIRK assesses 301 objectives across 4 major categories, 6 subcategories, and numerous classes of behaviors divided even further. Each repertoire is fully defined and includes a criterion for mastery. Students are assessed on each repertoire in the C-PIRK and those repertoires that are identified as missing are targeted for instruction.

Teacher training modules and the CABAS® rank system

The teacher training modules used today were in place 20 years ago. While the content and structure of their components has evolved, the basic tenets of what constituted effective teacher performance and measures of that performance were in place during the 1988-1989 school year. In CABAS® schools, we train our teachers using a Personalized System of Instruction across three types of repertoires—those involving 1) content expertise of the principles and tactics of the science of behavior, 2) application expertise, involving the delivery, consequation, measurement, and graphic display of instruction and student responses to instruction, and 3) analytic expertise, involving analysis of instructional difficulties and applications of scientific tactics to ensure student success. Assessment of student performance is ongoing and part of teaching, not something that is conducted infrequently or indirectly. Teachers always know where their students stand in terms of meeting state and individualized objectives and are therefore directly accountable to students, parents, and school districts. In fact, a recent Columbia University dissertation found that the only factor correlated to student achievement in our CABAS® system was teacher rank, or level of expertise. Factors found to have no correlation included teacher education, years of experience, inservice training, and self-efficacy (Scherzo, 2010).

Research Contributions to the Evolution of the CABAS® Model

It is likely that the additional components introduced to the CABAS® model over the years have contributed significantly to increases in our students' acquisition rates from 20 years ago and to the stability of their rates across weeks throughout the school year. Our assessments and curricula have been heavily informed by recent findings in the behavioral literature. Specifically, research that has most impacted our curriculum, in addition to those mentioned above (the learn unit, TPRA, and decision protocol), falls under the following broad categories: Verbal Behavior, Observational Learning, Conditioned Reinforcement, and Naming and Multiple Exemplar Instruction (MEI). Over 50 published research studies, more than 25 conceptual papers and books, and over 50 doctoral dissertations have come out of research conducted in CABAS® schools, many of them at the Fred S. Keller School, in the past 20 years across these and other topics in both the applied and basic science of behavior. Please visit www.cabasschools.org for a complete listing of all publications.

Verbal Behavior Development Theory

Verbal Behavior Development Theory or VBDT (Greer, & Keohane, 2005) has been integral in changing the way we assess and teach our students over the past several years. Specifically, what recent research has told us about language acquisition has greatly impacted our ability to assess and improve or even induce crucial verbal developmental capabilities to allow children to progress through levels of verbal behavior never before thought possible. From the many experiments that have been conducted on Naming (Horne & Lowe, 1996; Lowe, Horne & Hughes, 2005; Greer et al, 2005; Gilic, 2005;), we know that children who have this capability may learn up to four operants when they are only directly taught one. Further, the Naming capability allows children to learn language incidentally.

A wealth of research on Naming has led to system-wide assessment of whether this capability is missing and, when applicable, instruction leading to its instantiation for all of our students (Fiorile & Greer, 2007; Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005; Greer, Stolfi, & Pistoljevic, 2007; Greer & Speckman, 2009; Greer, Yuan, & Gautreaux, 2005; Speckman, Park, & Greer, 2007). The type of instruction responsible for the induction of the Naming capability involves multiple exemplar experiences that result in the transfer of stimulus function. Thus, multiple exemplar instruction, or MEI, has become a standard method of instruction for our students. Recent research has shown that MEI has been effective in inducing relational responding across such repertoires as mands and tacts (Nuzzolo-Gomez & Greer, 2004), oral and written spelling (Greer, Yuan & Gautreaux, 2005), and novel verb usage (Greer & Yuan, 2004), to name a few.

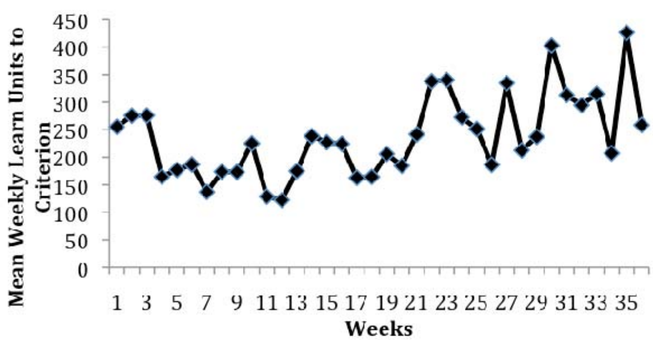
We also know now that those children who have prerequisite skills such as observing repertoires and listener literacy can benefit greatly from the above-referenced multiple exemplar procedures, but for those children who are lacking such capabilities, verbal capability protocols have been introduced. By identifying early developmental cusps and capabilities and having children progress through these protocols, children have mastered goals more quickly (Greer & Keohane, 2005; Greer & Ross, 2008; Keohane, Delgado, & Greer, 2009; Keohane, Luke, & Greer, 2008). The findings from these research studies have resulted in improvements in relevant components of the CABAS® model, as reflected in the results reported herein.

Results of our Comparative Analysis

We present comparative data from the 1988-1989 school year and data taken 20 years later in the 2008-2009 school year. The purpose of our review was to analyze and highlight what types of structural and functional changes have taken place at the Fred S. Keller School over the past two decades and how those changes may have affected the effectiveness of instruction for our students. We also sought to determine to what extent we can compare school-wide data from the two school years in terms of 1) levels and variability of the mean weekly ratio of learn units to criterion achieved and 2) the annual mean number of Teacher Performance Rate Accuracy measures conducted per student. We have also compared the composition of the PIRK (1986) and the C-PIRK (2009) criterion-referenced assessments.

Learn units-to-criterion, or simply put the number of instructional units it took for a student to meet one instructional objective, may be the single most important indicator of effective instruction in schools. It is a measure of the rate of learning for each child. We analyzed the school-wide data from the 1988-1989 school year and have compared the ratio of students' weekly learn units-to-criterion to those same data for the 2008-2009 school year (see Figure 1). During the 1988-1989 school year the ratio of learn units to a single criterion ranged from 122-426 weekly with a mean of 236. During the 2008-2009 school year the learn units to a single criterion ranged from 137-294 weekly with a mean of 155. Overall, the 2008-2009 learn units-to-criterion are at a lower level and are more stable across weeks. Variability can most be seen at the beginning of the school year, and can be partially explained by the initial intensive assessment and planning period for new students using the criterion-referenced C-PIRK.

SCHOOL YEAR 1988-1989



SCHOOL YEAR 2008-2009

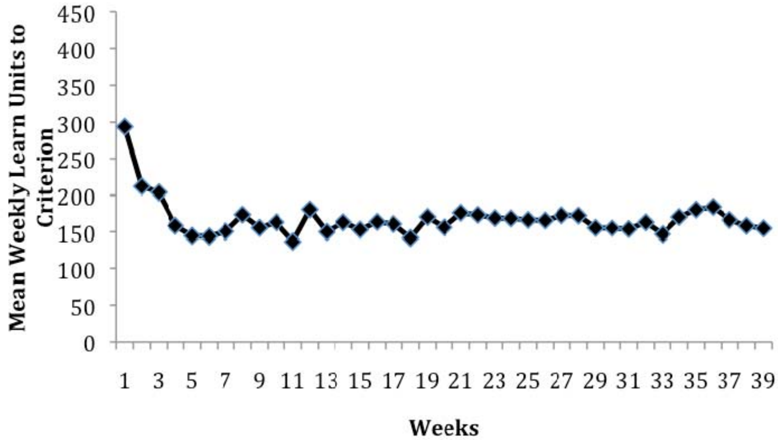


Figure 1. A comparison of the mean number of learn units-to-criterion across weeks for school years 1988-1989 and 2008-2009. The data from the 1988-1989 school year are more variable across weeks than the data from 2008-2009. The 1988-1989 data are presented across 36 weeks while the 2008-2009 data are presented across 39 weeks. This is attributable to differences in the school calendars for those years.

We also compared the means and standard deviations of both sets of data and found a 68% decrease in the mean and a 34% decrease in the standard deviation from the mean from 1988-1989 to 2008-2009 (see Figure 2). Figure 3 represents annual TPRA observations. The data show a slightly higher mean number of TPRAs per student conducted in the 2008-2009 school year. In 1988-1989 the Fred S. Keller School enrolled an annual total of 24 full-time equivalent students as compared to 103 in 2008-2009 (the number of full time equivalent students was calculated by totaling the number of 25 hour school weeks attended by all students and then dividing by 45 weeks). These TPRA comparisons suggest that the Keller School has grown its supervision relative to its student enrollment. This is a necessary factor in the successful implementation of the CABAS® model as has been demonstrated frequently since its inception.

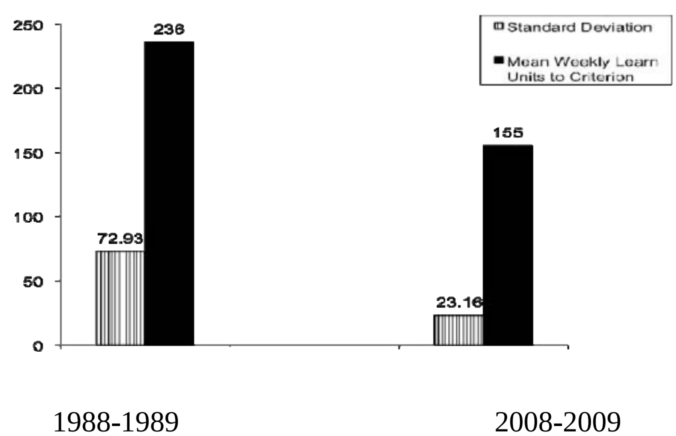


Figure 2. A comparison of standard deviations from the mean of weekly learn units to criterion and mean weekly learn units to criterion for school years 1988-1989 and 2008-

2009. The data from school year 2008-2009 shows a 68% lower mean for learn units to criterion and a 34% lower standard deviation from the mean.

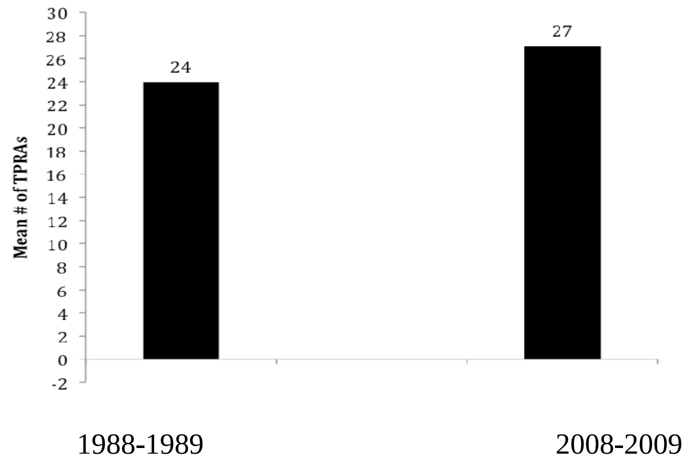


Figure 3. The mean number of Teacher Performance Rate Accuracy observations by Master Teachers and Behavior Analyst supervisors per student for school years 1988-1989 and 2008-2009. The data show a 12.5% increase in the number of TPRAs conducted per student from 1988-1989 to 2008-2009.

Table 1 shows a comparison of the numbers and categories of behaviors assessed by the Preschool Inventory of Repertoires for Kindergarten (PIRK) in 1988 and by the CABAS® International Curriculum and Inventory of Repertoires for Children from Preschool through Kindergarten (C-PIRK, 2009). The total number of behaviors assessed by the C-PIRK is 36% higher than the number of behaviors that were assessed by the PIRK. An increase in functional assessment items likely provides a more complete description of a student's capabilities and repertoires as well as his or her needs. This would enable a teacher or behavior analyst supervisor to choose more precise goals and interventions that may potentially lead to higher rates of acquisition.

Table 1

A comparison of repertoires assessed by the Preschool Inventory of Repertoires for Kindergarten (PIRK) in 1988 and repertoires assessed by the CABAS International Curriculum and Inventory of Repertoires for Children from Preschool through Kindergarten (C-PIRK) in 2009. The total number of behaviors assessed by the C-PIRK is 36% higher than the number of behaviors that were assessed by the PIRK.

Domain	PIRK	C-PIRK (2009)
Community of Reinforcers	16	
Social	12	subcategory of self-management
Emotional Affective	17	
Self-Management		57
School Self-Sufficiency	29	subcategory of self-management

Cognitive	84	
Academic Literacy		172
Physical Development	21	56
Communication	27	subcategory of academic literacy
TOTAL REPERTOIRES ASSESSED	190	301

Discussion

Reviewing progress of the Fred S. Keller School program over the past 20 years, or any behavior analytic model of instruction, can be challenging. It is, however, simplified by the fact that the school is a research based, data driven model. Student outcomes are what are most important and their measures drive all components of the model. While we are unable to definitively point to causal relations, we feel that we have highlighted some of the important changes that have taken place over the past two decades allowing us to draw some important comparisons illustrating the evolution of the CABAS® model.

The decrease in learn units-to-criterion for students as well as more stability in the data (Figures 1 and 2) can be attributed to many changes in the model of instruction over the past 20 years. The aforementioned decision-tree protocol for data analysis is essential for analyzing student progress and ensuring that ineffective teaching tactics are not utilized for any particular student for any prolonged length of time. As scientists, we know that not every teaching tactic is effective for every child. The corpus of behavioral literature provides us with over 300 different teaching tactics that can be applied when analyzing student data especially in situations where the student is not simply learning through the presentation of the learn unit. The data then need to be analyzed, taking into consideration the teacher's behavior, the student's instructional history, the response topography, instructional materials, motivation, and many other variables that are specific to that particular student. Using this information one can go to the behavioral literature and choose a tactic that may be a more effective way of teaching a particular skill to a student. This decision-tree protocol for teachers was not in place 20 years ago in the CABAS® system and we believe it is essential for effective behavior analytic teaching.

Many of the critical features of the CABAS® model were in place 20 years ago and have remained intact or been refined over the past two decades. Thus, teachers at the Fred S. Keller School, like all CABAS® trained teachers, can manage behavior that would otherwise interfere with instruction. They can measure and therefore assess student progress continually and effortlessly. They can identify learning difficulties early and analyze the data to figure out where the problem lies. They can apply research-based scientific tactics to remedy instructional and behavioral problems. They can evaluate, modify, or create, when necessary, curricula that are appropriate for their students. They can identify gaps in their students' repertoires that prevent them from making significant educational progress, such as missing developmental capabilities, and induce those using protocols identified through current research efforts. These include critical capabilities for the achievement of complex or higher-order concepts.

At the Fred S. Keller School, every administrator, behavior analyst supervisor, classroom teacher and teaching assistant is mandated to continuously work on teacher training modules included in our rank system. Employees are not paid contingent upon time on the job or college degree but their expertise of the science of behavior. This is demonstrated through completion of teacher training modules which include knowledge of their verbal behavior about the science, verbally mediated skills, and contingency-shaped skills which are measured based on their performance in classrooms. These training modules ensure that teachers show proficiency in data decision analysis and awareness of a wide variety of empirically tested teaching techniques. In situ observations are conducted several times weekly through the use of the TPRA procedure conducted by behavior analyst supervisors and master teachers in the school. This ensures that not only can they understand what is read in scientific journals and texts, but they can also take what is read and apply it to the classroom setting.

Our teachers are expertly trained because of how the CABAS® model is organized (Greer, Keohane, & Healy, 2002; Greer, 2002). CABAS® is a cybernetic system, at the heart of which lie the students. The students drive the system because the teachers' performance is measured based on their students' performance. Students learn only as fast as their teachers can teach them. The number of learn units received and the number of objectives achieved by students is a direct measure of teacher behavior. And, those objectives are tied directly to state standards, so our teachers are accountable at all levels for the achievement of their students. Our model is designed such that, just as teachers are responsible for their students' achievement, teacher mentors and behavior analyst supervisors are responsible for the performance of their teachers. And beyond that, CABAS® consultants and university faculty are responsible for the performance of teacher mentors and behavior analysts.

For the past 5 years CABAS® has been implemented in elementary general education classrooms where our system of schooling is called the Accelerated Independent Learner Model. The goal is to teach repertoires and induce capabilities that children need to succeed in the general education setting. We are taking pieces of this model and implementing them in our integrated preschool and toddler classes. The data presented in this paper demonstrate The Fred S. Keller School has been successful in improving the quality of life of many children with disabilities. We now seek to utilize what we've learned with young children from disenfranchised backgrounds in order to test whether our model, particularly its focus on language (Naming) as well as our assessments enable us to bridge the educational achievement gap for these children.

What do the next two decades hold for CABAS®? Research- based behavior analytic programs like ours should be just that; based on research conducted at their schools as well as other empirically tested methods found in the scientific literature. Teaching techniques at CABAS® schools will continue to be driven by the research that can empirically prove the most efficient ways to teach our students and teachers. Curriculum for students is constantly changing and our teaching techniques are constantly being built upon. The instructional learning modules by which our teachers are trained are simultaneously being amended to be able to supply them with the latest and most efficient teaching strategies. We will continue to demonstrate that good teaching is not an art, but a science, and that good teaching practices and models can be replicated.

References

Albers, A. & Greer, R. D. (1991). Is the three-term contingency trial a predictor of effective instruction? *Journal of Behavioral Education*, *1*, 337-354.

Fiorile, C. A. & Greer, R. D. (20017). The induction of Naming in children with no prior tact responses as a function of multiple exemplar histories of instruction. *The Analysis of Verbal Behavior, 23*(1)**,** 71–87.

Gilic, L. (2005). Development of Naming in two-year-old children. (Unpublished doctoral dissertation), Columbia University, New York.

Greer, R.D. (1991). Teaching practices to save America's schools: The legacy of B.F. Skinner, *Journal of Behavioral Education, 1,* 159-164.

Greer, R. D. (1994). The measure of a teacher. In I. R. Gardner et. al. (Eds.), Behavior analysis in education: Focus on measurably superior instruction. Pacific Groves, CA: BrooksCole.

Greer, R. D. (2002). *Designing teaching strategies: An applied behavior analysis systems approach*. San Diego, CA: Academic Press.

Greer, R. D. and Keohane, D. D. (2005). The evolutions of verbal behavior in children. *Behavioral Development Bulletin* 1: 31-47. Reprinted in 2006 in the *Journal of Speech and Language Pathology: Applied Behavior Analysis* 1(2): http://www.behavior-analyst-today.com

Greer, R.D., Keohane, D., & Healy, O. (2002). Quality and comprehensive applications of behavior analysis to schooling. *The Behavior Analyst Today, 3,* 120-132.

Greer, R. D., McCorkle, N., & Williams, G. (1989). A sustained analysis of the behaviors of schooling. *Behavioral Residential Treatment*, *4*(2), 113-141.

Greer, R. D. & McDonough, S. H. (1999). Is the learn unit the fundamental unit of pedagogy? *The Behavior Analyst*, *20*, 5-16.

Greer, R. D. & Ross, D. E. (2008) *Verbal behavior analysis: Inducing and expanding new verbal capabilities in children with language delays.* Boston: Pearson Education, Inc.

Greer, R.D. & Speckman, J. (2009). The integration of speaker and listener responses: A theory of verbal development. *The Psychological Record*, *59*, 449-488.

Greer, R. D., Stolfi, L. Chavez-Brown, M. and Rivera-Valdes, C. L. (2005). The emergence of the listener to speaker component of naming in children as a function of multiple exemplar instruction. *The Analysis of Verbal Behavior*, *21*, 123-134.

Greer, R. D., Yuan, L., & G. Gautreaux. (2005). Novel dictation and intraverbal responses as a function of a multiple exemplar instructional history. *The Analysis of Verbal Behavior, 2,* 99-116.

Horne, P. J. & Lowe, C. F. (1996). On the origins of Naming and other symbolic behavior. *Journal of the Experimental Analysis of Behavior*, *65*, 185-241.

Ingham, P. & Greer, R. D. (1992). Changes in student and teacher responses in observed and generalized settings as a function of supervisor observations of teachers. Journal of Applied Behavior Analysis, 25, 153-164.

Keohane, D. D., Delgado, J. P., & Greer, R.D. (2009). Observing responses: Foundations of higher order verbal operants. In Y. Barnes-Holmes & R. Rehfeldt (Eds.), *Applications of relational frame theory* (pp. 41-62). Los Angeles: Harbinger Press.

Keohane, D. D. & Greer, R. D. (2005). Teacher's use of verbally governed algorithm and student learning. *International Journal of Behavioral Consultation and Therapy*, *1*, 252-271.

Keohane, D. D., Luke, N., & Greer, R. D. (2008). The things we care to see: The effects of rotated protocol immersion on the emergence of early observing responses. *Journal of Early and Intensive Behavioral Interventions*, *5*(1), 23-39.

Lamm, N. & Greer, R.D. (1991). A systematic replication and a comparative analysis of CABAS®. *Journal of Behavioral Education, 1,* 421-444.

Lowe, C.F., Horne, P.J. & Hughes, J.C. (2005). Naming and categorization in young children III: Vocal tact training and transfer of function. *Journal of the Experimental Analysis of Behavior, 83(1), 47-65*Nuzzolo-Gomez, R. & Greer,

R.D. (2004). The emergence of untaught mands or tacts with novel adjective-object pairs as a function of instructional history. *The Analysis of Verbal Behavior, 24*, 30-47.

Ross, D. E., Singer-Dudek, J., & Greer, R. D. (2005). The teacher performance rate accuracy scale (TPRA): Training as evaluation. *Education and Training in Developmental Disabilities*, *40,* 411-423.

Scherzo, K. (2010). The role of teacher-student relationships in an early childhood Comprehensive Application of Behavior Analysis to Schooling (CABAS®) setting. Doctoral dissertation, Teachers College, Columbia University, New York, NY.

Selinske, J., Greer, R.D., & Lodhi, S. (1991). A functional analysis of the comprehensive application of behavior analysis to schooling. *Journal of Applied Behavior Analysis, 13,* 645-654.

Vaughn, S. & Fuchs, L.S. (2003). Redefining learning disabilities as inadequate responses to instruction: the promise and potential problems. *Learning Disabilities Research and Practice, 18, 3,*137-146.

Waddington, E. M. & Reed, P. (2009). The impact of using the "Preschool Inventory of Repertoires for Kindergarten" (PIRK®) on school outcomes for children with Autistic Spectrum Disorders. *Research in Autism Spectrum Disorders, 3,* 809-827.

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