*Education and Training in Developmental Disabilities, 2005, 40(4), 411–423*

# The Teacher Performance Rate and Accuracy Scale (TPRA): Training as Evaluation

Denise E. Ross
Teachers College, Columbia University

Jessica Singer-Dudek
St. John's University

R. Douglas Greer
Teachers College, Columbia University

*Abstract: The purpose of this paper is to introduce the Teacher Performance Rate and Accuracy Scale (TPRA) which is a method of direct teacher observation used in the teacher evaluation and training component of the Comprehensive Application of Behavior Analysis to Schooling (CABAS®) model of schooling. The TPRA builds on the concept of academic engaged time (a measure frequently employed during ecobehavioral assessment) by counting the presence or absence of learn units (interlocking three-term contingencies for both students and teachers) during instruction. Implementation procedures for the TPRA, its application for identification and analysis of instructional problems, and its use for training and ongoing evaluation of teachers are presented and discussed.*

Evaluating teachers' instructional effectiveness and providing feedback are components of teacher training that have been used to improve both teachers' performances and students' learning (Andrejko, 1998; Howard & McColskey, 2001; Munby, 1999; Rauch & Whittaker, 1999; Smith, Harris, & Sammons, 2001). Approaches to teacher evaluation have included reviewing professional development plans (Holland & Adams, 2002), examining teacher work samples (Denner, Salzman, & Bangert, 2001), conducting peer reviews (Kumrow & Dahlen, 2002), and evaluating professional portfolios (Moore & Bond, 2002). Research suggests that such approaches have been most effective when they occurred regularly, were part of proactive professional development programs, were based on multiple measures, and resulted in information to help improve instruction (Protheroe, 2002).

Such methods of teacher observation and feedback may often include indirect measures of instructional effectiveness such as parental questionnaires, students' evaluations, and teachers' self-reports (Bahr & Bahr, 1997; Hersen & Bellack, 2002). While these measures can provide feedback to teachers, research suggests that indirect measures of classroom instruction do not always reflect actual changes in instructional effectiveness or students' learning, but rather the reporter's verbal description of an intervention's effectiveness (Hawkins, 1991; Poling, Methot, & LeSage, 1995). For example, Miller and Kelley (1994) found that although homework completion rates increased, parents reported dissatisfaction with their children's rates of homework completion following an intervention to increase homework completion rates. Similar incongruent relationships between teachers' reports and students' performances have also been identified in both science and music education (Maranzano, 2000; Moore, 2003).

Some researchers have suggested that the primary measure of instructional effectiveness should be objective measures and not information obtained from subjective evaluations (Hawkins, 1991; Schwartz & Baer, 1991). Direct observation is one method of teacher evaluation and training that may more accu-

---

Correspondence concerning this article should be addressed to Denise E. Ross, Health and Behavior Studies, Teachers College, Columbia University, 525 West 120th Street, Box 223, New York, NY 10027.

rately and objectively show actual changes in both teachers' behaviors and students' learning than the previously discussed indirect measures (Hawkins; Schwartz & Baer). Research on classroom environments has shown that direct observational scales can measure both teachers' and students' behaviors which can, subsequently, be manipulated to increase students' learning (Greenwood, Carta, Kamps, Terry, & Delquadri, 1994). For example, research on classroom environmental variables has shown direct positive correlations between improved student learning and teachers' manipulation of students' rates of: 1) opportunities-to-respond (Greenwood, Hart, Walker, & Risley, 1994), 2) active student responding (Heward, 1994), 3) academic engaged time (Fisher et al., 1980) and 4) contingent reinforcement (Madsen, Becker, & Thomas, 1968).

A common method of measuring relationships between teachers' behaviors and students' learning is ecobehavioral assessment. This type of assessment uses momentary time sampling to compare students' behaviors in the context of teachers' behaviors and other classroom variables and to determine which variables promote high rates of academic engaged time (Greenwood & Delquadri, 2002; Logan & Malone, 1998). Greenwood, Carta, et al. (1994) described a computerized ecobehavioral software system—the Ecobehavioral Assessment Scale (EBASS)—designed to record the presence or absence of a students' behaviors (i.e., academic and inappropriate classroom behaviors), a teachers' behaviors (i.e., teacher's position in the classroom), and classroom variables (i.e., physical arrangement) in inclusive, specialized, and preschool settings (Greenwood & Delquadri). EBASS has been used to accurately record data on observable classroom variables such as effects of time of day on students' behavior (Muyskens & Ysseldyke, 1998), time spent on reading for students with learning disabilities and emotional/behavioral disorders (Vaughn, Levy, Coleman, & Bos, 2002), amount of academic engaged time for students with disabilities in inclusive settings (McDonnell, Thorson, McQuivey, & Kiefer-O'Donnell, 1997; Wallace, Anderson, & Bartholomay, 2002), and variables that promote engagement during academic responding (Greenwood, Horton, & Utley., 2002).

Ysseldyke and Christenson (as cited in Christenson & Anderson, 2002) designed The Instructional Environment Scale (TIES-II) which is another model of ecobehavioral assessment used to collect direct observational data on individual students' classroom behaviors across four categories: planning, management, delivery, and monitoring/evaluation (Spicuzza et al., 2001). Compiled information is reported in percentages of time and can be used to determine relationships between environmental factors and an individual student's learning and to promote factors that increase learning (Quinn & McDougal, 1998). TIES-II has been used to compare significant differences between variables in classrooms of typical elementary school children and children at-risk for severe emotional disabilities (Lago-Delello, 1998; Montague & Rinaldi, 2001) and to show the differential effects of a math curriculum on the pre and post academic achievement of students with varying ability levels (Spicuzza et al., 2001).

Research suggests that while ecobehavioral scales have been useful for identifying classroom variables that contribute to students' learning, their usefulness and efficiency for changing teachers' classroom instruction is limited for at least three reasons (Greenwood et al., 2002). First, while the primary purpose of such analyses has been to measure academic engaged time (Greenwood, Carta, et al., 1994; Logan & Keefe, 1997), ecobehavioral assessments have been largely restricted to descriptive-correlational analyses and have not resulted in changes to teachers' instructional behaviors that affect academic achievement (Greenwood et al., 2002; Juniper Gardens Children's Project, 2001). Second, codes used during ecobehavioral observations can be complex. Greenwood and Delquadri (2002) noted that, to date, EBASS has been limited to observations of single students because of the observations' complexity. Finally, implementing ecobehavioral assessments can become costly. Greenwood et al. (2002) suggested that use of computerized software for ecobehavioral assessment was expensive and required resources that were not routinely available to school personnel.

The purpose of the present paper is to introduce the Teacher Performance Rate and Accuracy Scale (TPRA), a relatively simple and efficient method of direct teacher observation and evaluation that has been used to change teachers' behaviors and students' learning by employing a measure that builds on the concept of academic engaged time (Greer, 1994, 2002; Greer, Keohane, & Healy, 2002; Ingham & Greer, 1992). Specifically, the TPRA directly measures three-term contingencies presented by teachers in order to assess functional interrelationships between teachers' behaviors, students' responses, and instructional stimuli—interrelationships which research has shown to comprise academic engaged time (Heward, 1994). The TPRA is an integral part of the teacher evaluation and training component of the Comprehensive Application of Behavior Analysis to Schooling (CABAS®), which is a behavior analysis systems approach to education. The TPRA was designed to reflect and increase components of teaching shown to be effective in the literature such as higher rates of students' correct responses, higher rates of opportunities to respond, lower rates of students' incorrect responses, and lower rates of teachers' instructional errors (Greer, 2002).

### *Research Background*

The TPRA builds on the concept of measuring academic engaged time by counting the presence or absence of *learn units* (Albers & Greer, 1991; Emurian, 2004; Emurian, Hu, Wang, & Durham, 2000; Greer, 1994; Greer, 2002; Greer, McCorkle, & Williams, 1989; Greer et al., 2002; Ingham & Greer, 1992; McDonough & Greer, 1999; Selinske, Greer, & Lodhi, 1991). Table 1 provides an example of a learn unit. Learn units consist of three-term contingencies for students and interlocking three-term contingencies for teachers. In other words, learn units measure occurrence of antecedents, behaviors, and consequences for both teachers and students during instruction. Greer (2002) termed the measure *learn unit* since both teachers and students "learn" from the interaction in a symbiotic manner. Using the learn unit as a measure of teaching allows for isolation of teaching and learning from moment-to-moment as students respond to teachers' instructions and teachers respond, in turn, based on behaviors of their students. Using the learn unit as a measure permits simultaneous assessment of both teachers and students since learn units are measures of teachers' behaviors and responses to learn units are measures of students' behaviors.

Findings from behavior analysis, the TPRA, and the learn unit comprise the research background for the TPRA. First, according to Greer (1994), at least four bodies of research from 1960-1990 in behavior analysis have contributed to the research background for the TPRA. These include research bodies showing relationships between: 1) rates of contingent teacher approvals and disapprovals and corresponding decreases and increases in undesirable student behaviors (Heward, 1994), 2) conditioning and generalized stimulus control which suggested that previously non-preferred academic tasks such as reading and writing could be reinforced to levels that would maintain behavior in non-instructional settings (Greer, 1994), 3) increased correct student responding and students who received high numbers of opportunities-to-respond (Greenwood, Hart, et al., 1994), and 4)

**TABLE 1**

**Example of Learn Unit with Interlocking Three-term Contingencies for Teacher and Student**

| *Three-term Contingencies for Teacher* | *Instructional Components* | *Three-term Contingency for Student* |
|---|---|---|
| First teacher antecedent | *Student attends to teacher* | |
| First teacher behavior | *Teachers says, "Count to 10"* | Student antecedent |
| First teacher consequence/ second teacher antecedent | *Student correctly counts to 10* | Student behavior |
| Second teacher behavior | *Teachers says, "Good job!"* | Student consequence |
| Second teacher consequence | *Teacher records data and learn unit is completed* | |

applied behavior analysis and academic behaviors such as those found in the research on Direct Instruction which showed that applied behavior analysis was useful for academic tasks as well as classroom management (Becker, 1992).

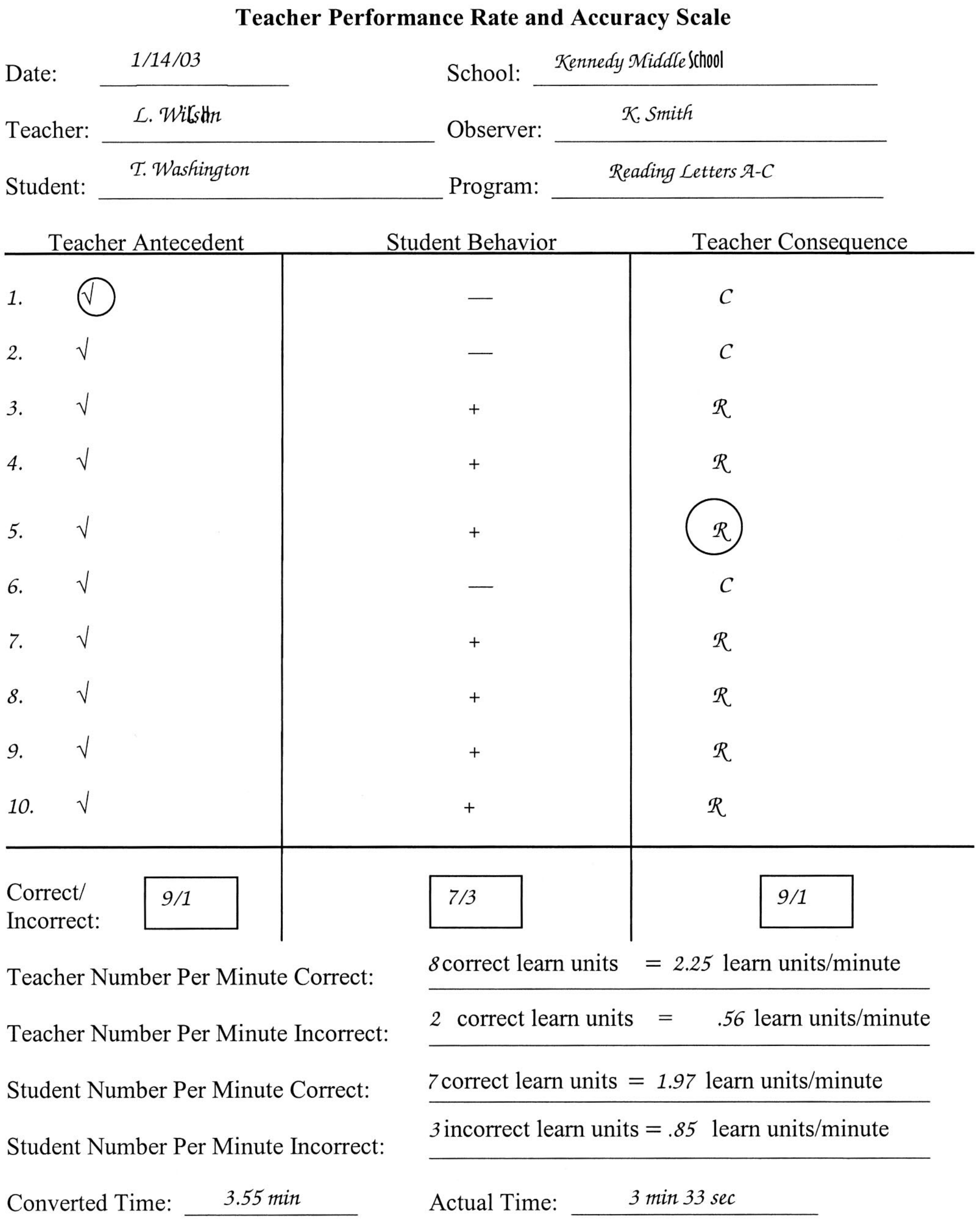
Second, research on the TPRA showed relationships between TPRA observations and students' learning. Three studies found correlations between high numbers of supervisor-conducted TPRA observations and increased teacher productivity, contingent consequences during instruction, and learning of students with severe mental retardation attending CABAS® schools (Greer, McCorkle, & Williams, 1989; Lamm & Greer, 1991; Selinske, Greer, & Lodhi, 1991). Additionally, Ingham and Greer (1992) found generalized and higher functional relationships between TPRA scores and correct student responses when compared to nonspecific feedback (i.e., "Nice lesson") for teachers of students with mental retardation. Albers and Greer (1991) showed similar results for students in remedial mathematics classrooms and also found that high rates of correct academic behaviors for teachers and students were not different for vocal versus written teacher instructional presentations.

Third, research on the learn unit resulted in response definitions for TPRA components. Research suggested that antecedent presentations should be unambiguous (Albers & Greer, 1991; Ingham & Greer, 1992) and that students must actively respond during response opportunities (Greenwood, Hart, et al., 1994; Heward, 1994). Additionally, student learning increased more with the consequence component than with the opportunity-to-respond alone (that is, the antecedent and intraresponse time) (Albers & Greer; Greenwood, Hart, et al.; Greer, 1996). Research also showed that postcedents emitted in the form of correction or reinforcement operations were necessary for student learning (Albers & Greer; Ingham & Greer) and that students should attend to written discriminative stimuli presented during correction procedures (Hogin, 1996). Research on the number and rate of learn unit presentations suggested that faster and higher rates of learn units resulted in increased correct responses by students (Ingham & Greer; Linhart-Kelly & Greer, 1997) as well as higher numbers of correct responses and objectives attained by students (Greer et al., 1989; Ingham & Greer; Selinske et al., 1991) and as much as four to seven times more correct responding than during baseline (Albers & Greer; Greer et al., 1989; Ingham & Greer). Finally, recent research suggests that learn units are useful for measuring and changing instruction in both college classrooms (Bahadourian, 2000) and computer-assisted instruction (Emurian, 2004). Subsequent research has shown that learning problems can be pinpointed and corrected based on the components of the learn unit (Greer, 2002; Keohane, 1997).

### *Implementing the TPRA*

TPRA observations are generally conducted by trained supervisors or mentor teachers, and can be used with varying class sizes (i.e., whole groups or individual students) by an observer whose use of the TPRA has been calibrated to 90% accuracy across multiple observational sessions with a trainer. Figure 1 and the procedure outlined below illustrate steps to complete a TPRA observation form for a single student. Table 2 describes steps to complete the TPRA for groups of students and for complex academic behaviors.

First, the teacher and supervisor identify the following instructional components: 1) a target student, 2) a target instructional program, 3) operational definitions of target behaviors for the student and corresponding correct and incorrect responses, 4) schedule(s) of reinforcement for the instructional session, 5) antecedents and postcedents, 6) instructional conditions under which behavior should occur, and 7) necessary prerequisite skills that the student should have before instruction is implemented. The supervisor also observes availability of related instructional materials such as data collection forms, items serving as reinforcers, writing utensils, and curricular supplies (i.e., textbooks, flashcards). Finally, the supervisor and the teacher review the student's graphs to determine 1) trends in student's responses to the target program prior to the pending observation, 2) consistency of plotted data with accurate graphing protocol, and 3) appropriateness of the target program and expected level of student response.



**Teacher Performance Rate and Accuracy Scale**

Date: 1/14/03
School: Kennedy Middle School
Teacher: L. Wilson
Observer: K. Smith
Student: T. Washington
Program: Reading Letters A-C

| | Teacher Antecedent | Student Behavior | Teacher Consequence |
|---|---|---|---|
| 1. | √ | — | C |
| 2. | √ | — | C |
| 3. | √ | + | R |
| 4. | √ | + | R |
| 5. | √ | + | R |
| 6. | √ | — | C |
| 7. | √ | + | R |
| 8. | √ | + | R |
| 9. | √ | + | R |
| 10. | √ | + | R |
| Correct/ Incorrect: | 9/1 | 7/3 | 9/1 |

Teacher Number Per Minute Correct: 8 correct learn units = 2.25 learn units/minute
Teacher Number Per Minute Incorrect: 2 correct learn units = .56 learn units/minute
Student Number Per Minute Correct: 7 correct learn units = 1.97 learn units/minute
Student Number Per Minute Incorrect: 3 incorrect learn units = .85 learn units/minute
Converted Time: 3.55 min
Actual Time: 3 min 33 sec

**Figure 1. Example of a completed TPRA form.**

Second, the supervisor and, when appropriate, the teacher (i.e., in a fluency program) start a timer (i.e., a stopwatch) or record the analog time in minutes and seconds. Timing during TPRA observations begins with the teacher's presentation of the first antecedent within a set of learn units which comprise an instructional session. The timer is stopped only if an interruption occurs (i.e., a problem with another student or school-related disruptions) in which case the timer begins again when instruction resumes. The timer is for-

**TABLE 2**

**Procedures for TPRA Observations Conducted with Groups and Complex Academic Behaviors**

1. Record learn units for classroom management separately by using an "A" for correct social approvals and a "D" for correct social disapprovals administered by the teacher.
2. Use written work that incorporates vocal responses such as worksheets or computerized programs.
3. Indicate the beginning and end of observational periods with vertical lines drawn on written work (i.e., worksheets).
4. Record vocal learn units (V) separately from written learn units (W).
5. Count written learn units when the student has reviewed corrections and completed changes. This may not occur until the next class period.
6. Elapsed time is calculated by adding the time required to complete problems on the day of the observation to the time involved to complete the corrections.
7. Homework time is included by adding the number of minutes in a day that responses are reviewed and corrected by students to the actual instructional time.

mally stopped when the teacher delivers the final postcedent. Elapsed time is used to calculate rate of instruction and TPRA scores.

During the instructional session, the teacher records students' correct and incorrect responses to instruction based on the operational definition described before the lesson. Correct student responses occur when the student emits a behavior consistent with the operational definition within a specified intraresponse time (i.e., 5 seconds). Incorrect student responses occur when the student emits a behavior inconsistent with the operational definition, does not emit the correct behavior within the specified intraresponse time, omits a response, or emits a correct response after emitting an incorrect response (i.e., self-correction). Incorrect responses and response omissions are recorded as minuses (−) and correct responses are recorded as pluses (+). Using event recording, teachers record responses immediately after each postcedent by using pencil and paper method (on a pre-existing data collection sheet), mechanical counters, or a computerized data collection tool. When responses to textual passages are the target behavior, the teacher records correctly and incorrectly read words by marking on an identical version of the passage that is photocopied or covered with a transparent overlay.

Using the TPRA form (see Figure 1), the supervisor records the accuracy of each component of the learn unit based on information collected with the teacher before the observational session. First, the supervisor measures the teacher's presentation of instructional antecedents as correct or incorrect. Correct antecedents occur if the teacher's vocal and/or nonvocal antecedent stimulus was unambiguous, consistent with the lesson plan or script, and, in the case of curricular materials, the target stimuli were flawless (i.e., targeted stimulus features were salient). Correct antecedent presentations are recorded under the "antecedent" column (A) with a checkmark. Incorrect antecedent presentations are recorded under the same column with a circled checkmark.

Second, students' responses are recorded in the same manner described above for the teacher. That is, the observer marks correct student responses with a plus (+) and incorrect student responses with a minus (−). These data are compared with the teacher's collection of student data upon completion of the observation for interobserver agreement purposes.

Third, the teacher's presentation of postcedents is recorded. These are measured as correct and incorrect based on their contingent relationship to the student's responses. That is, teachers should perform reinforcement operations contingent upon correct student responses and correction procedures contingent upon incorrect student responses. A correct reinforcement operation is defined as immediate presentation of a stimulus that functions as a reinforcer for the target student on the schedule of reinforcement specified for the instructional session. An appropriate correction procedure is defined by the scripted program, school, or classroom protocol. In most cases, correction procedures include the teacher's presentation of the lesson's antecedent stimulus with an accompanying prompt or model for the target behavior. Corrections are not reinforced and the student is required to emit the corrected response. Table 3 identifies various teacher postcedents and the corresponding TPRA codes used to record them.

During or after formal observation, the supervisor provides feedback to the teacher in one or more of three forms. Supervisors may provide oral feedback by reviewing correct and incorrect learn units with the teacher based on the TPRA form. Written feedback is provided by recording comments about specific learn units on the TPRA form and giving the form to the teacher to review. Supervisors may also stop TPRA observations and correct teachers' behaviors immediately—in which case the TPRA observation begins again as instruction resumes. When this happens, the supervisor may change an instructional procedure, model a correct procedure, verbally prompt the teacher to perform an instructional operation, or explain a procedure. Feedback is not provided during a session in which an interruption would be disruptive for a student. Teachers respond to TPRA feedback by demonstrating that they can identify instructional problems and problem-solve using a decision tree (Greer, 2002; Keohane, 1997) by asking the supervisor questions based on written comments. When feedback is given within an instructional session, teachers correct problem areas during subsequent learn unit presentations or lessons.

**TABLE 3**

**Codes for TPRA Observations**

| *Code* | *Response Definition* |
|---|---|
| √ | Antecedent presented correctly |
| √⃝ | Antecedent presented incorrectly |
| + | Correct student response |
| − | Incorrect student response |
| R | Reinforcement operation presented correctly |
| Ⓡ | Reinforcement operation omitted or presented incorrectly |
| C | Correction operation presented correctly |
| Ⓒ | Correction operation omitted or presented incorrectly |
| D | Social disapproval presented correctly |
| Ⓓ | Social disapproval omitted or presented incorrectly |
| A | Social approval presented correctly |
| Ⓐ | Social approval omitted or presented incorrectly |
| W | Written antecedent presentation |
| V | Vocal antecedent presentation |

### *Formulas*

The first calculation is rate of correct and incorrect responses for the student. First, all responses (including response omissions) are tallied and total number of incorrect responses is separated from total number of correct responses. Next, elapsed time is converted into minutes by dividing seconds by 60. One minute and 20 seconds (1:20), for example, would become 1.33 minutes. Then, number of correct and incorrect responses is each divided by the converted time and a rate of correct and incorrect responses is obtained.

The second calculation is rate of correct and incorrect responses for the teacher. Learn units are correct if both antecedents and postcedents were presented accurately during observation. Learn units are incorrect if either antecedent or postcedent were presented incorrectly during observation. Both correct and incorrect learn units are summed and divided separately by the converted time to obtain a rate of correct and incorrect responses for the teacher.

For example, during a lesson whose duration was 10 minutes, a teacher delivered 20 instructional antecedents accurately but ignored two correct responses which means that the teacher presented 18 correct learn units with 2 errors. Since the lesson's duration was 10 minutes, 18 would be divided by 10 for a TPRA score of 1.8 correct learn units presented per minute and .2 incorrect learn units presented per minute. That means that students were given opportunities to actively respond and to receive reinforcement and feedback for their responses approximately twice per minute.

### *Analysis of Data*

Comparing TPRA scores is restricted to the same instructional programs by the same teacher with the same students because of variations in students' learning histories, curricular objectives, and levels of teachers' expertise. For instance, some learn units contain multiple behaviors instead of a single student response; such is the case for programs that involve larger teacher antecedents, larger student responses, varying schedules of reinforcement, and different types of reinforcers. When this happens, regardless of number of student behaviors, it is the teacher's delivery of the consequence that defines the learn unit. A common example is when students learning to write complex essays have fewer learn units than students learning to write 25 spelling words because the placement of the teacher's consequence during instruction determines size of the learn unit (at the end of an essay versus at the end of each spelling word). Similarly, completing a page of mathematical problems would include multiple responses to a single antecedent. Likewise, citing a 10-digit telephone number may begin with a single response (i.e., the number 4) but, eventually, require 10 different numbers for a single correct response.

TPRA scores can be displayed graphically across time or summed and divided by the number of observations to obtain a mean accuracy TPRA score. Improved TPRA scores suggest the following: 1) shorter latent time periods between learn units to students which translates into greater amounts of instruction, 2) fluent teacher presentations, and 3) increased contingency-shaped behaviors instead of rule-governed behaviors (i.e., teachers who emit automatic behaviors instead of accessing procedures to instruct). For both teachers and students, accurate rates should increase, inaccurate rates should decrease, and changes in students' performances should be analogous to changes in teachers' performances.

TPRA scores can be used in school-wide summaries of data and for teacher-supervisor conferences conducted after observations. Specifically, when mean weekly scores for a single teacher are integrated into a school's TPRA data, both composite and individual TPRA data can be used to help identify learning objectives for students and teachers. Composite data help schools analyze a number of variables that CABAS® research has shown to be functionally related to accurate student and teacher performance including the number of supervisor observations completed (Greer et al., 1989; Ingham & Greer, 1992), supervisor expertise in solving instructional problems (Greer, 2002; Keohane, 1997), and setting learn unit targets for teacher performance (Albers & Greer, 1991). When teachers' incorrect performances are relatively low and stable, cumulative data reflecting the number of observations with and without errors are displayed.

### *Use for Instructional Decisions*

When accurate and inaccurate data do not reflect divergent trends in performance (that is, ascending and descending trends, respectively) but teacher performance is errorless, other components of instruction are reviewed as possible sources for student learning problems by using an instructional analysis decision protocol and the learn unit context (i.e., motivational variables or learning history) (Greer, 2002; Keohane, 1997). Possible sources of the problem may be that the (a) student lacks the prerequisite skills to respond to the material being presented, (b) student lacks the topography or the response, (c) instructional materials are insufficient for acquiring stimulus control, or d) schedule of reinforcement is too thin. While ability to change some curricular problems does not lie in the TPRA observation itself (i.e., what to teach when a student lacks prerequisite skills), the observational procedure allows an observer or teacher to indicate that this is the area of the problem. Later, the information can be used in conjunction with a skilled teacher mentor to change a curricular problem. Changing a curricular problem is usually completed by using the decision protocol (Keohane, 1997) to analyze the learn unit content and to determine which of 200 research-based tactics (Greer) is likely to solve a particular instructional or learning problem. Table 4 lists common instructional errors, their associated TPRA components, and potential solutions. Case studies illustrating the application of TPRA data to instructional decisions are provided below.

### *Case Studies*

*Changing instructional errors.* Teachers A and B were co-teachers in an inclusive first grade classroom where Janet, a 6-year old girl

**TABLE 4**

**Common Instructional Errors Related to TPRA Components**

| *TPRA Component* | *Instructional Errors* | *Potential Solutions* |
|---|---|---|
| Antecedent | Vocal or written antecedent presented incorrectly or inconsistently | Review antecedents in program script or protocol |
| Antecedent | Target stimuli flawed or not salient | Make target stimulus dimensions salient |
| Antecedent | Opportunity-to-respond inconsistent or omitted | Use timer to prompt teacher to begin and end intraresponse time (i.e., five seconds) |
| Antecedent | Incorrect prompt presented or correct prompt presented inconsistently | Review prompt levels and fading procedures with teacher |
| Behavior | Student lacks prerequisite skills | Teach student prerequisite skills |
| Behavior | Inappropriate prompt level | Use different prompt level or error correction procedure |
| Behavior | Response topography is too complex | Task analyze target behavior and include prompts where needed |
| Behavior | Size of learn unit too large | Task analyze target behavior to change size of learn unit |
| Consequence | Student has no opportunity-to-respond consequence component | Prompt teacher to include opportunity-to-respond |
| Consequence | Reinforcers not potent or satiation | Vary reinforcers or perform establishing operation |
| Consequence | Reinforcers not delivered on appropriate schedule | Decrease or increase schedule of reinforcement |
| Consequence | Reinforcers not delivered immediately or contingently | Prompt teacher to deliver reinforcers before he/she records students' data |
| Number per minute | Correct responses per minute are too low | Increase teacher's automatic/ contingency-shaped learn unit presentations |

with autism, was learning to read sight words aloud. Teachers used the learn unit—that is, interlocking three-term contingencies for the teacher with the potential operant for the student—to teach Janet the target words. The teachers alternately presented each of four 20-learn unit instructional sessions. Janet only emitted a mean of 14.5 correct responses (range, 13 to 18) and did not obtain the instructional objective of 90% mastery. TPRA observations showed that Teacher A presented 6.51 correct learn units and 0 incorrect learn units per minute, but Teacher B presented 4.56 correct learn units and 1.95 incorrect learn units per minute. Teacher B's errors were in the omission of an opportunity-to-respond during correction operations. The supervisor modeled the appropriate correction operation, observed Teacher B again, and Janet achieved mastery criteria within the next two instructional sessions.

*Increasing number of learn units emitted per minute.* Teacher C was a reading teacher for 9th grade students with learning disabilities. She received TPRA observations on her implementation of a new behavioral reading program following training. During one 30-minute observation, she presented 64 complete learn units, but 104 additional antecedents to which students responded but were not reinforced or corrected. The supervisor showed Teacher C the TPRA scores and requested that she present a higher number of contingent correction and reinforcement operations during the next lesson. During a second 30-minute observation, Teacher C presented 102 complete learn units and only 52 antecedents without consequences.

*Training student teachers.* As part of the masters of arts program at Teachers College, groups of student teachers wrote instructional programs for children in CABAS® schools which were, subsequently, evaluated using the TPRA. One group wrote an instructional program to teach children with disabilities to emit conversations in three increasingly complex social situations. Children obtained mastery criteria in the simplest social situations but not in the most complex social situation. Since multiple TPRA data showed that student teachers correctly presented all antecedents and consequences in each social situation, the mentoring teacher could eliminate faulty antecedents and consequences as the source of learning difficulty and examine other areas of the learn unit as possible sources for the children's low number of correct responses (i.e., prerequisite skills or the program's generalization components).

## Conclusion

The purpose of this paper was to describe the TPRA by presenting its research background, implementation procedures, formulas and data analysis, and instructional implications. The TPRA, an integral component of teacher training and evaluation in CABAS® schools, measures teacher-student interactions during instruction by assessing frequency of learn units. Learn units are defined as interlocking three-term contingencies (antecedents, behaviors, and consequences) for teachers and students. During timed instructional sessions conducted with various group sizes (i.e., ranging from single students to whole classes), trained observers use event recording to measure the accuracy of teachers' antecedent and postcedent presentations as well as the accuracy of students' responses. The accuracy of the learn unit's components and subsequent rate calculations of teachers' and students' correct and incorrect learn units per minute are used to remediate instructional errors associated with the learn unit—that is, the antecedents, behaviors, and consequences for both teachers and students.

As previously mentioned, observations from ecobehavioral assessment literature provide one basis for why the TPRA may be valuable for changing teacher behavior. Specifically, ecobehavioral assessment was intended to identify variables that promote academic engagement (e.g., instructional tasks or groups) (Greenwood et al., 2002). However, while information derived from ecobehavioral assessment has increased students' academic responding (Greenwood et al.), to date ecobehavioral assessments have mostly been descriptive-correlational and have not identified ways to promote engagement through altered classroom instruction (Greenwood et al.). What appears to be lacking in the research literature is a description of a simple measure that assesses teachers' instructional behaviors and that can be used to change them (Greenwood et al.). The TPRA is a relatively simple and efficient method of teacher observation that has been used to change teachers' instructional behaviors during training and evaluation.

When the TPRA was used weekly over one or more academic years as part of a teacher training and evaluation program, researchers found correlational and functional relationships between its use by a trained observer and teachers' and students' instructional responses, including increased numbers of: 1) instructional sessions taught, 2) learning objectives achieved, 3) correct student responses, 4) learn units per minute, 5) opportunities-to-respond, and 6) presentations of learn units during non-observational periods (Greer et al., 1989; Ingham & Greer, 1992; Lamm & Greer, 1991; Selinske et al., 1991). Based on these studies, a possible explanation for the procedure's effectiveness and why it may be a valuable tool for teacher evaluation and training is provided below.

The TPRA may be a useful tool for evaluating teaching because its primary measure, learn units, not only builds on opportunity-to-respond, but may also explain what is important about academic engaged time. Both academic engaged time and opportunity-to-respond have been shown to predict academic achievement – that is, higher amounts of time spent on tasks that promote academic success and higher numbers of opportunities-to-respond are correlated with student achievement and on-task behavior (Greenwood, Hart, et al., 1994). However, research suggests that learn units produce more student learning than opportunities-to-respond alone (Heward, 1994; Ingham & Greer, 1992) and result in relatively high amounts of feedback for teachers about student learning and in relatively high amounts of on-task behaviors for students (Heward). Academic engaged time, as a measure, uses time as a primary dimension, but does not account for the number of learn units that teachers present during instruction (Heward). If learn units are the point of contact between teachers and students (Heward) then the learn unit may be a basic measure of teaching (Greer, 1994, 2002). As such, the TPRA, which measures learn units within time, is a valuable tool for measuring and effecting behaviors of teachers.

There is still much to learn about measuring teacher-student interactions at the teacher level. Over the past 20 years, an estimated 300,000 TPRA observations have been completed across at least 20 schools involving more than 500 teachers. As part of teacher training and observation in eight CABAS® schools in the United States, Ireland, and England, more than 3.8 million data points are generated from TPRA observations and learn unit data derived from instructional sessions with teachers, parents, students, and supervisor. Based on our experiences with this procedure, a primary benefit of the TPRA is that this observational tool is a simple procedure that can provide in-class training for and evaluation of teachers without costly, out-of-class workshops or equipment (Ingham & Greer, 1992).

## References

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

Andrejko, L. (1998). The case for the teacher portfolio. *Journal of Staff Development, Staff 19,* 45–48.

Bahadourian, A. (2000). *The effects of learn units on student performance in two college classrooms.* Unpublished doctoral dissertation. Teachers College, Columbia University.

Bahr, M. W., & Bahr, C. M. (1997). Educational assessment in the next millennium: Contributions of technology. *Preventing School Failure, 41,* 90–94.

Becker, W. (1992). Direct instruction: A twenty-year review. In R. West & L. Hammerlynck (Eds.), *Design for educational excellence: The legacy of B. F. Skinner* (pp. 71–112). Longmont, CO: Sopris West.

Christenson, S. L., & Anderson, A. R. (2002). Commentary: The centrality of the learningcontext for students' academic enabler skills. *The School Psychology Review, 31,* 378–393.

Denner, P. R., Salzman, S. A., & Bangert, A. W. (2001). Linking teacher assessment to student performance: A benchmarking, generalizability, and validity study of the use of teacher work samples. *Journal of Personnel Evaluation in Education, 15,* 287–307.

Emurian, H. H., Hu, X., Wang, J., & Durham, D. (2000). Learning JAVA: A programmed instruction approach using Applets. *Computers in Human Behavior, 16,* 395–422.

Emurian, H. H. (2004). A Programmed Instruction Tutoring System for Java": Consideration of Learning Performance and Software Self-Efficacy. *Computers in Human Behavior, 20,* 423–459.

Fisher, C. W., Berliner, D. C., Filby, N. N., Marliave, R., Cahen, L. S., & Dishaw, M. M. (1980). Teaching behaviors, academic learning time, and student achievement: An overview. In C. Denham & A. Lieberman (Eds.), *Time to learn* (pp. 7–32). Washington, DC: U.S. Department of Education.

Greenwood, C. R., Carta, J. J., Kamps, D., Terry, B., & Delquadri, J. (1994). Development and validation of standard classroom observation systems for school practitioners: Ecobehavioral assessment systems software (EBASS). *Exceptional Children, 61,* 197–210.

Greenwood, C. R., & Delquadri, J. (2002). Code for instructional structure and student academic response: CISSAR. In M. Hersen & A. S. Bellack (Eds.), *Dictionary of behavioral assessment techniques* (pp. 120–122). New York: Percheron Press.

Greenwood, C., R., Hart, B., Walker, D. I., & Risley, T. (1994). The opportunity to respond and academic performance revisited: A behavioral theory of developmental retardation and its prevention. In R. Gardner, D. M. Sainato, J. O. Cooper, T. E. Heron, W. L. Heward, J. Eshelman, et al. (Eds.), *Behavior analysis in education: Focus on measurably superior education* (pp. 213–224). Pacific Grove, CA: Brooks/Cole.

Greenwood, C. R., Horton, B. T., & Utley, C. A. (2002). Academic engagement: Current perspectives on research and practice. *The School Psychology Review, 31,* 328–349.

Greer, R. D. (1994). The measure of a teacher. In R. Gardner, D. M. Sainato, J. O. Cooper, T. E. Heron, W. L. Heward, J. Eshelman, et al. (Eds.), *Behavior analysis in education: Focus on measurably superior education* (pp. 161–171). Pacific Grove, CA: Brooks/Cole.

Greer, R. D. (1996). The education crisis. In M. A. Mattaini & B. A. Thyer (Eds.), *Finding solutions to* *social problems: Behavioral strategies for change* (pp. 113–146). Washington, DC: American Psychological Association.

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

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

Greer, R. D., Keohane, D., & Healy, O. (2002). Quality and comprehensive applications of behavior analysis to schooling. *The Behavior Analyst Today, 3, 120–132.* Retrieved December 22, 2003, from http://www.behavior-analyst-online.org/BAT/BAT-32.pdf

Hawkins, R. P. (1991). Is social validity what we are interested in? Argument for a functional approach. *Journal of Applied Behavior Analysis, 24,* 205–213.

Hersen, M., & Bellack, A. S. (2002). *Dictionary of behavioral assessment techniques.* New York: Percheron Press.

Heward, W. L. (1994). Three "low-tech" strategies for increasing the frequency of active student response during group instruction. In R. Gardner, D. M. Sainato, J. O. Cooper, T. E. Heron, W. L. Heward, J. Eshelman, et al. (Eds.), *Behavior analysis in education: Focus on measurably superior education* (pp. 283–320). Pacific Grove, CA: Brooks/Cole.

Hogin, S. E. (1996). *Essential contingencies in correction procedures for increased learning in the context of the learn unit.* Unpublished doctoral dissertation. Columbia University, New York.

Holland, P. E., & Adams, P. (2002). Through the horns of a dilemma between instructional supervision and the summative evaluation of teaching. *International Journal of Leadership in Education, 5,* 227–247.

Howard, B. B., & McColskey, W. H. (2001). Evaluating experienced teachers. *Educational Leadership, 58,* 48–51.

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

Juniper Gardens Children's Project. (2001). *EBASS.* Retrieved December 22, 2003, from University of Kansas, Juniper Gardens Children's Project Web site: http://www.jgcp.ku.edu/EBASS/ebass_descrp.htm

Keohane, D. (1997). *A functional relationship between teachers' use of scientific rule-governed strategies and student learning.* Unpublished doctoral dissertation, Columbia University, New York.

Kumrow, D., & Dahlen, B. (2002). Is peer review an effective approach for evaluating teachers? *Clearing House, 75,* 238–241.

Lago-Delello, E. (1998). Classroom dynamics and the development of serious emotional disturbance. *Exceptional Children, 64,* 479–492.

Lamm, N., & Greer, R. D. (1991). A systematic replication of CABAS in Italy. *Journal of Behavioral Education, 1,* 427–444.

Linhart-Kelly, R., & Greer, R. D. (1997, May). Rate mastery and the long-term maintenance of sight words. Paper presented at the 23rd Annual International Conference of the Association for Behavior Analysis, Chicago, IL.

Logan, K. R., & Keefe, E. B. (1997). A comparison of instructional context, teacher behavior, and engaged behavior for students with severe disabilities in general education and self-contained elementary classrooms. *The Journal of the Association for Persons with Severe Handicaps, 22,* 16–27.

Logan, K. R., & Malone, D. M. (1998). Instructional contexts for students with moderate, severe, and profound intellectual disabilities in general education elementary classrooms. *Education and Training in Mental Retardation and Developmental Disabilities, 33,* 62–75.

Madsen, C. H., Jr., Becker, W. C., & Thomas, D. R. (1968). Rules, praise, and ignoring: Elements of elementary classroom control. *Journal of Applied Behavior Analysis, 1,* 139–150.

Maranzano, C. (2000). Music teacher performance evaluation: A call for more inclusive models. *Journal of Personnel Evaluation in Education, 14,* 267–274.

McDonnell, J., Thorson, N., McQuivey, C., & Kiefer-O'Donnell, R. (1997). Academic engaged time of students with low-incidence disabilities in general education classrooms. *Mental Retardation, 35,* 18–26.

McDonough, S. H., & Greer, R. D. (1999). Is the learn unit a fundamental measure of pedagogy? *The Behavior Analyst, 22,* 5–16.

Miller, D. L., & Kelley, M. L. (1994). The use of goal setting and contingency contracting for improving children's homework performance. *Journal of Applied Behavior Analysis, 27,* 73–84.

Montague, M., & Rinaldi, C. (2001). Classroom dynamics and children at-risk: A follow-up. *Learning Disability Quarterly, Learning Disability 24,* 73–84.

Moore, J. (2003). Evaluating teaching is important. *Journal of Chemical Education, 80,* 119. Retrieved October 23, 2003 from http://JchemEd.chem-.wisc.edu Moore, Z., & Bond, N. (2002). The use of portfolios for in-service teacher assessment: A case study of foreign language middle-school teachers in Texas. *Foreign Language Annals, 35,* 85–92.

Munby, H. (1999). Planning, implementing, and evaluating a field-based teacher education program: An introduction. *Teacher Education Quarterly, 26,* 5–9.

Muyskens, P., & Ysseldyke, J. E. (1998). Student academic responding as a function of classroom ecology and time of day. *The Journal of Special Education, 31,* 411–424.

Poling, A., Methot, L. L., & LeSage, M. G. (1995). *Fundamentals of behavior analytic research.* New York: Plenum Press.

Protheroe, N. (2002). Improving instruction through teacher observation. *Principal, 82,* 48–51.

Quinn, K. P., & McDougal, J. L. (1998). A mile wide and a mile deep: Comprehensive interventions for children and youth with emotional and behavioral disorders and their families. *The School Psychology Review, 27,* 191–203.

Rauch, K., & Whittaker, C. R. (1999). Observation and feedback during student teaching: learning from peers. *Action in Teacher Education, 21,* 1999.

Schwartz, I. S., & Baer, D. M. (1991). Social validity assessments: Is current practice state of the art? *Journal of Applied Behavior Analysis, 24,* 189–204.

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, 24,* 107–117.

Smith, P. L., Harris, C. M., & Sammons, L. (2001). Using multimedia portfolios to assess preservice teacher and P-12 student learning. *Action in Teacher Education, 22,* 28–39.

Spicuzza, R., Ysseldyke, J., Lemkuil, A., Kosciolek, S., Boys, C., & Teelucksingh, E. (2001). Effects of curriculum-based monitoring on classroom instruction and math achievement. *Journal of School Psychology, 39,* 521–542.

Vaughn, S., Levy, S., Coleman, M., & Bos, C. S. (2002). Reading instruction for students with LD and EBD: A synthesis of observation studies. *The Journal of Special Education, 36,* 2–13.

Wallace, T., Anderson, A. R., & Bartholomay, T. (2002). An ecobehavioral examination of high school classrooms that include students with disabilities. *Exceptional Children, 68,* 345–359.

---

Received: 11 February 2004
Initial Acceptance: 4 April 2004
Final Acceptance: 10 October 2004